

# **NASA Technical Memorandum 104615**

## **NASAwide Electronic Publishing System-- Electronic Printing and Duplicating, Stage-2 Evaluation Report (Goddard Space Flight Center)**

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**NASAwide Electronic Publishing System--  
Electronic Printing and Duplicating,  
Stage-2 Evaluation Report  
(Goddard Space Flight Center)**

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## EXECUTIVE SUMMARY

The purpose of the extension of the NASAwide electronic duplicating system evaluation to include the Goddard Space Flight Center (GSFC) was to expand the agencywide functionality for electronic duplicating and through its inclusion, assess whether this technology would be more cost effective than the current process. Additional elements which differs from previous evaluation is the inclusion of the Xerox Document on Demand (XDOD) system and the use of a two phase approach to the evaluation. This report continues the evaluation reported in "NASA Electronic Publishing System -- Electronic Printing and Duplicating Evaluation Report" (NASA TM 106242) and "NASA Electronic Publishing System -- Stage 1 Evaluation Report" (NASA TM 106510).

The report is presented in three sections; the Introduction describes the duplicating configuration under evaluation; the Background and History is a chronological description of the evaluation segmented by phases-1 and -2. Included in this section of the report are the evaluation schedule, printing and duplicating requirements, storage and communication requirements, electronic publishing system configuration, existing processes, proposed processes, billing rates, costs and productivity analysis, and the return on investment based upon the data gathered to date. The phase-1 analysis demonstrated that GSFC should proceed with the evaluation of the DocuTech and XDOD on a 90-day evaluation or phase-2 cycle to actually demonstrate that the proposed system would meet the needs of GSFC's printing and duplicating requirements. The Phase-2 90-day Evaluation section describes the benchmark requirements, pre-benchmark testing, benchmark results, validation of the cost analysis, and the final comparative cost summaries. The appendices contain supporting information. The following paragraphs document the cost savings and potential productivity increases as a direct result in the acquisition of the Xerox networked DocuTech and the Xerox Document on Demand systems.

The first year potential cost savings (\$462,000), excluding labor costs, and productivity gains in terms of reduction in response time (78 to 1,150 percent) are shown in Figure 1 and 2 respectively. Figure 1 shows the comparative costs for GPO and in-house duplicating, the networked DocuTech/XDOD costs, and the phase-2 revenue gained using the cost algorithm assigned during the phase-2 90-day evaluation cycle for annual impressions of 19,015,638.

Specific details on the costs are shown in Figure 16, Pricing and Table 6, Final comparative cost summaries. Specific details on productivity gains are shown in Figure 19, Productivity comparisons, and Table 2, Pre-benchmark comparisons.

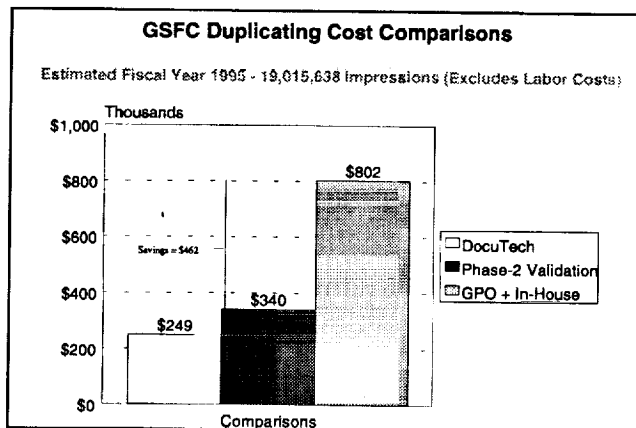


Figure 1. Cost comparisons.

**GSFC Productivity Gains**

Estimated Based Upon Total Processing Time

Function	Current	DocuTech and XDOD	Productivity Savings
Automatic Label Addressing	Affect Labels Manually	Automatic	1,150.00% (Figure 20)
File Transfer	Delivers Hard Copy to Service Desk	Electronic File Transfer	78.33% (Table 2)
GPO	Obtains Bids and Orders (Five Day Turnaround)	Electronic File Transfer or Hard Copy Deliver to Service Desk	80.00% (Figure 19)
XDOD	Not in Production	Image Enhancement and Document Assembly	Potentially Significant (Table 3)

Figure 2. Productivity gains.

In summary, the phase-2 evaluation validates that the networked DocuTech and XDOD is cost effective and more efficient than the current process of printing, duplicating and editing. Figure 21 displays a cost benefit ratio of 0.60 (reference column G, roll 80) and return on investment ratio of 1.21 (reference column c, roll 72) which include an inflation factor of 2.5% per year for supplies and labor costs. Alternative cash flow comparisons over a five year period are display by Figure 21 by referring to

- Roll 66 - GPO
- Roll 67 - In-House duplicating
- Roll 68 - GPO/In-House duplicating combined
- Roll 69 - DocuTech only
- Roll 70 - DocuTech and Xerox Document on Demand (DocuTech/XDOD)

Figure 2A displays the computed savings through the use of the DocuTech/XDOD versus the previous method of sending all work to GPO and in-house duplicating, reference Table 6 and Figure 21. The return on investment during the first year increases to 2.70 (reference column C, roll 73), if an assumption can be made that a 0.5% productivity increase will occur through the use of this technology.

Additionally, potential future savings can be obtained in terms of mailing and storage costs. These potential savings have not been computed at this time as the current process versus a re-engineer process operational requirements have not been collected. However, once this data has been gather, the savings can be calculated using the information provided in the section on storage and communication requirements.

Figure 2B displays the first year of operational costs by cost component. The one-time charge is for technical support, training, and purchase of network software for the DocuTech. The cost per thousand of \$21.51 is based upon an annual volume of 19,015,638 impressions versus cost per thousand of \$27.37 for 29,353,644 impressions, reference Table 6 and Figure 21.

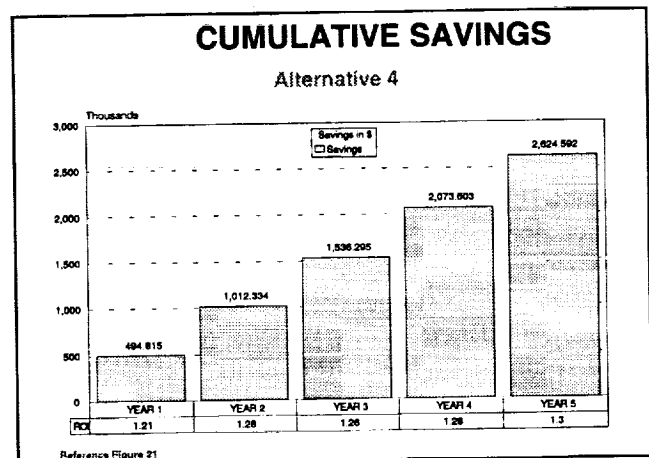


Figure 2A. Cumulative savings.

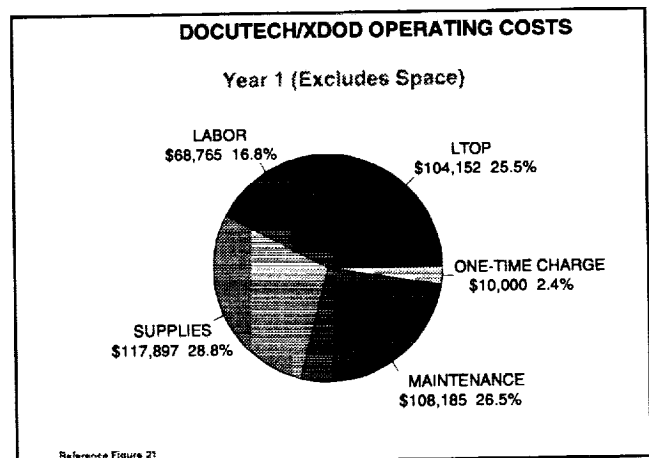


Figure 2B. Operating costs.

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## INTRODUCTION

The NASA Scientific and Technical Information Office (STIO) has been assigned the responsibility to include the Goddard Space Flight Center (GSFC) in the NASAwide Electronic Publishing System - Electronic Printing and Duplicating. This responsibility resulted from a need to assist the GSFC to reengineer their printing and duplicating services. As part of this evaluation, the GSFC printing and duplicating services will be examined to determine the cost benefits in the integration into the NASAwide electronic duplicating configuration. This evaluation will be conducted in two phases; the first phase will determine whether the installation of a electronic printing and duplicating system is cost effective and meets the printing and duplicating requirements for GSFC, and the second phase will consist of a 90-day evaluation of a printing and duplicating system on site with a benchmark conducted within 60 days from installation and acceptance to demonstrate that the system will meet the GSFC requirements and to validate the productivity gains.

During the phase-1 evaluation cycle, a zero base cost acquisition of the phase-2 evaluation cycle will be implemented. That is, sufficient ongoing printing and duplicating work will be identified to be accomplished on the phase-2 evaluation cycle without violating Joint Committee on Printing (JCP) thresholds, thereby permitting the reallocation of funding from this work to the electronic printing and duplicating system.

Currently, six NASA installations (Lewis Research Center, Jet Propulsion Laboratory, Kennedy Space Center, Marshall Space Flight Center, Johnson Space Center, and Ames Research Center) have the electronic duplicating system installed. All will have networked capability by the end of 1994. The GSFC's electronic duplicating system will be determined through the evaluation of the networked DocuTech 135 in fulfilling the storage/duplicating/finishing requirements and to determine whether it is the best and most cost effective solution for Goddard.

The author acknowledges the many individuals who have contributed to the material contained in this evaluation report. Specific thanks go to the following individuals: Ms. Betty Graham, technical editor, Goddard Space Flight Center, who spent many hours in making this report available to NASA Headquarters; the Printing Management staff for their outstanding contributions in assembling and executing the networked DocuTech system evaluation at GSFC; the Publications staff for their outstanding contributions in assembling and executing the documents on demand evaluation at GSFC; Ms. Marilyn Tolliver and the Logistics Management staff in providing challenging applications for the networked DocuTech/Documents on Demand system; Ms. Hermina Thompson, Xerox Corporation, for her expertise and contributions in documenting the current process and proposed processed flow for applications on the networked DocuTech. There are many other contributors who are not named here, but who are mentioned in appendix 1 or throughout the evaluation report. Without their participation, this evaluation report could not have been written.

## BACKGROUND AND HISTORY

### Phase 1 - Chronology

The following is a chronology of highlights of the stage-2 project:

Mar 94	GSFC's Printing Management Officer has accepted Code JTT's assistance in the conduct of a cost benefit study to assist them in making the determination for the acquisition of an electronic duplicating system. This confirmation was accomplished on March 22, 1994. The Institutional Printing Management Officer (IPMO) will be gathering the necessary production statistics and coordinating with GSFC organizational codes on their duplicating requirements.
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A meeting was scheduled with the GSFC staff responsible for printing and duplicating on March 30, 1994, to initiate the evaluation and to determine evaluation team assignments.

On March 30, 1994, Code JTT (Dick Tuey) met with GSFC staff to brief them on the progress to date regarding the networked DocuTech evaluation. GSFC attendees were

- |    |                               |          |
|----|-------------------------------|----------|
| 1. | Beth Booker, Code 239         | 286-9594 |
| 2. | Bob Lane, Code 253.2          | 286-5449 |
| 3. | Theresa Wirth, Code 253       | 286-4422 |
| 4. | Betty Graham, Code 253.1      | 286-6645 |
| 5. | Sue Hart, Code 253.1          | 286-2800 |
| 6. | Richard Schmadebeck, Code 682 | 286-3089 |
| 7. | Preston Pope, Code 253.2      | 286-8673 |
| 8. | Dwayne Kronser, Code 253      | 286-7976 |
| 9. | Marilyn Tolliver, Code 230    | 286-2211 |

The general tone of the meeting was favorable to the evaluation, and some concerns were expressed by the attendees. Before a system such as the networked DocuTech can be acquired, it must be demonstrated that there are overall savings and not just a break-even scenario. The meeting ended with Mr. Kronser assigning Mr. Lane the task of determining who will participate as evaluation team members for the study. A later phone conversation with Mr. Lane indicated that he, Ms. Wirth, and Mr. Pope will examine the current duplicating work with their users to assess whether the DocuTech would be a viable option for them. Input from these discussions was conveyed to Mr. Tuey during the first week of April 1994.

Apr 94

Mr. Bob Lane provided a brief overview of the status of their requirements identification and indicated that progress has been made and a major application that could be moved to the DocuTech had been identified. Discussions concerning this application and other requirement determinations was scheduled for April 15 at GSFC.

At the scheduled meeting, representatives of GSFC (Mr. Bob Lane, Mr. Preston Pope, Ms. Theresa Wirth) and Code JTT (Mr. Fred Moore, Mr. Dick Tuey) readdressed the overall requirements for a networked electronic publishing system. Mr. Lane and Mr. Moore agreed to identify a list of Government Printing Office (GPO) printing requirements by May 9 which could be diverted to the acquisition of a 90-day evaluation of an electronic duplicating system without violating the GPO printing thresholds. The amount of GPO printing required would be the identification of enough GPO work to fund approximately \$7,000 per month for 3 months. By using this alternative, no additional funding will be required. During the meeting, Ms. Wirth expressed some concern that the schedule to have an initial evaluation report completed by June 24 was extremely optimistic. Mr. Tuey stated that the goal was not to identify all requirements but enough to provide the funding for the 90-day period. Once the system is installed and GSFC staff are aware of its existence and capabilities for doing their duplicating work cheaper and faster, it will sell itself.

May 94

On May 17, 1994, Code JTT staff (Mr. Fred Moore and Mr. Dick Tuey) met with GSFC staff (Mr. Dwayne Kronser, Mr. Bob Lane, and Mr. Don Ellis) regarding the networked electronic publishing system. Mr. Kronser's past concerns have now been satisfied by the NASA

General Counsel's ruling that NASA has no legal requirement to comply with the JCP duplicating threshold of 5,000/25,000 production units (reference the General Counsel's letter of May 4, 1994.) (Appendix 3.) With this ruling in hand, GSFC is now prepared to move forward with the evaluation of a networked electronic publishing system as originally proposed on March 22, 1994. Mr. Kronser and staff will decide the direction the evaluation should take. During this interim period, Mr. Tuey will proceed with the documentation as identified by the evaluation schedule in Figure 1. Mr. Kronser will explore the setup of an account whereby funds can be accumulated from various GSFC users of printing and duplicating services to pay for the 90-day evaluation of an electronic publishing system.

May 94

During the week of May 23, 1994, Code JTT staff assisted the GSFC in preparing the Justification for Other Than Full and Open Competition (JOFOC) for the evaluation of the networked DocuTech 135B/Documents on Demand System. Pricing information and verification of the utility of the system is currently in process by Xerox, with submission of this information to NASA by the first week in June 1994.

Code JTT staff (Fred Moore and Dick Tuey) met with Xerox staff (Scott Friedlander, Hermina Thompson, and Karen Murphy) on May 31, 1994, to discuss the GSFC applications being considered for the evaluation, along with the evaluation costs that will be incorporated into the JOFOC. Ms. Thompson provided an extensive analysis of the proposed applications that support the no-cost increase in duplicating and publication costs for GSFC's Printing and Duplicating Services Section and Publications and Graphics Services Section.

Jun 94

On June 7, 1994, the JOFOC for the acquisition of the networked DocuTech/Documents On Demand system on a Lease to Ownership Plan (LTOP) was completed, along with the phase-1 evaluation report to be discussed with GSFC staff on June 8.

On June 8, 1994, Code JTT staff (Fred Moore and Dick Tuey) met with GSFC staff (Dwayne Kronser, Bob Lane, Preston Pope, Susan Hart, and Luann Bindschadler) to review the JOFOC and phase-1 draft evaluation report for the acquisition of the networked DocuTech/Documents On Demand system. Based upon the information gathered to date, Mr. Dwayne Kronser is now convinced that the proposed evaluation of the subject system is a worthwhile project and that it will meet, in terms of real dollars, a yield of 25% reduction in duplicating costs for its customers. Clarification as to the requirements of the electronic document interchange project between Code JTT and GSFC (Sue Hart) was accomplished with slight modification to the Memorandum of Understanding (MOU) between GSFC's Code 253.1 and Code JTT. During this meeting, GSFC agreed to edit the stage-2 evaluation report for Code JTT.

GSFC staff (Bob Lane) has requested that Xerox provide a briefing on the morning of June 24, 1994, to five GSFC staff who will be providing funding for the 90-day evaluation of the networked DocuTech/Documents on Demand system. The GSFC staff are specifically interested in the use of the networked DocuTech for GSFC forms or handbooks, and demonstration of this type of application is being prepared for the GSFC staff by Xerox staff who will meet with them on June 22, 1994, in preparation for the June 24 demonstration.

On June 24, 1994, Xerox briefed and demonstrated the DocuTech to GSFC and Headquarters staff at their Rosslyn, Virginia, customer demonstration center. Attendees were

1.	Beth Booker	Code 239	(301) 286-9594
2.	Jackie Cooper	Code 231	(301) 286-8823
3.	Marilyn Tolliver	Code 231	(301) 286-2211
4.	Carol Ladd	Code 253	(301) 286-3612
5.	Dick Tuey	Code JTT	(202) 358-1395

Mr. Scott Friedlander provided a brief overview of the capabilities of the DocuTech along with samples of actual publications, forms, brochures, etc., produced by the DocuTech from other Federal Agencies. Ms. Hermina Thompson and Ms. Karen Murphy demonstrated the capabilities of the DocuTech for specific GSFC applications. These were the scanning in of a two-sided printed form (Procurement Request Package Route Sheet), a three-part Plant Operations Management Division (POMD) Work Request with instructions for completing the form on the backside of the third page, and a 100-page handbook printed on both sides with inserts, followed by the reproduction of copies for each of the GSFC attendees. The GSFC staff were favorably impressed with the capabilities of the DocuTech and are anxious to thoroughly evaluate its capabilities on site.

On June 29, 1994, Code JTT staff (Fred Moore and Dick Tuey) met with GSFC staff (Bob Lane) to finalize the specific pricing and components for the 90-day evaluation of the DocuTech/Documents on Demand system. At this time, Bob Lane's coordination with the GSFC budget staff decided that for accounting purposes, it would be easier to fund the evaluation directly from within Code 253, instead of transferring funds from other codes within GSFC.

## **Phase 2 - Chronology**

**Jul 94** By July 11, 1994, Bob Lane had received a work order number (fund citation) to prepare the purchase requisition for the 90-day evaluation of the DocuTech/Documents on Demand system. Supporting documentation to the purchase order are the JOFOC and the Phase-1, NASAwide Electronic Publishing System - Stage-2 Evaluation Report, both dated July 1, 1994. Bob Lane confirmed the installation date of the Xerox DocuTech/Xerox Documents on Demand (XDOD) system as July 29, 1994. DocuTech training was scheduled for July 25, 1994, with initial operation on August 1, 1994. The schedule for installation has been accelerated from the estimated installation date of September 14, 1994, to July 29, 1994, a reduction of 47 calendar days.

On July 22, 1994, Dick Tuey met with Sue Hart to coordinate the GSFC prototype Scientific and Technial Information (STI) Electronic Document Interchange system and its physical location during the phase-2 evaluation cycle. As part of the evaluation of the networked DocuTech, Xerox is providing a bundled documents on demand system, which will be evaluated to determine if it meets the operational needs of the GSFC Publications and Graphics Section. A separate project plan is being prepared for this effort, but will be implemented in a manner that does not impact the overall production of the networked DocuTech. After meeting with Sue Hart, Dick Tuey met with Bob Lane and Debra Mitchell (duplicating technician) regarding the physical location of the networked DocuTech, along with a discussion on the initial establishment of user account codes. This will enable the Printing and Duplicating Services Section to gather the necessary data to determine the appropriate algorithm for charging the GSFC customers for their duplicating services.

On July 29, 1994, Headquarters staff (Fred Moore and Dick Tuey) met with GSFC staff (Bob Lane, Susan Hart, and Dwaine Kronser), Jorge Scientific Corporation (Jason Delooze), and Xerox staff (Karen Murphy, Linda Dickerson, Angela Howell, and Scott Friedlander) on the status of the networked DocuTech/XDOD installation and the evaluation requirements. A brief overview was provided by Dick Tuey, who covered general objectives of the evaluation, key benchmark requirements, key reference documents, and the phasing schedule for the prototype STI Electronic Document Distribution project and the networked DocuTech. After the full installation of the networked DocuTech/XDOD, biweekly status meetings will be scheduled to ensure that the evaluation system is meeting all the requirements of GSFC and that any problems which show up can be addressed immediately and resolved by Xerox.

Aug 94

On August 26, 1994, Headquarters staff (Fred Moore and Dick Tuey) met with GSFC staff (Bob Lane, Susan Hart, and Dwaine Kronser), Jorge Scientific Corporation (Jason Delooze), and Xerox staff (Karen Murphy, Linda Dickerson, Brett Raaum, Hermina Thompson, and Lorenzo Barnes) on the status of the networked DocuTech/XDOD installation. Mr. Bob Lane indicated that two problems need to be resolved by Xerox, the first dealing with additional training for the GSFC duplicating operator regarding extended storage, and the second regarding the response time in repair calls, e.g., the cover insertion module. Ms. Hermina Thompson provided an extensive briefing covering the DocuTech installation implementation strategy for GSFC. Items covered during the briefing were roles and responsibilities (Xerox, GSFC, and Headquarters), installation support, customer training, technical problem resolution, application development, and system consultative services. The XDOD delivery and installation have been scheduled for August 29, 1994, with training targeted for September 12, 13, and 14. Delivery occurred on August 30, 1994.

On August 29, 1994, Dick Tuey received the first set of statistical user accounts from Debbie Mitchell, GSFC DocuTech operator. Ms. Mitchell will be faxing these reports at the end of each week during the phase-2 evaluation cycle.

On August 30, 1994, the Printing and Duplicating Services Section held a Focus Group Session with GSFC external and internal users. Mr. Bob Lane introduced Dick Tuey (NASA Headquarters) and William Davis (Government Printing Office) to the attendees. Dick Tuey provided an overview of the NASAwide Electronic Publishing System -- Electronic Printing and Duplicating, and William Davis provided an overview of the services that the GPO provides. Bob Lane provided an overview of the GSFC Printing and Duplicating Services Section's organizational structure. Xerox (Scott Friedlander) provided a brief overview of the functionality of the DocuTech and Xerox Documents on Demand system. Following the presentations, a roundtable discussion with all attendees was conducted. In summary, many concerns, issues, and problems with printing by GPO and capabilities of the DocuTech were covered. Fred Moore emphasized his philosophy, that once a print job is submitted, it should be done right the first time, no reprinting or discounts. Additionally, he suggested to Bob Lane that subsequent sessions, such as today's session, be conducted again.

Sep 94

On September 8, 1994, Sue Hart provided a brief status of the XDOD installation. The installation appears to be completely in place; however, Xerox has not demonstrated that the system is ready to be used. A Transmission Control Protocol/Internet Protocol (TCP/IP) unique address has been assigned to the XDOD system. At this time, GSFC staff training for the XDOD system is in a state of flux because of conflicting schedules and will slip to the week of September 19, 1994. Xerox staff (Karen Murphy) has been notified to ensure that

communication links between the Networked DocuTech and XDOD are operational for the September 27, 1994, GSFC Open House.

On September 30, 1994, Dick Tuey met with Debbie Mitchell, GSFC duplicating technician on gathering statistics (by job, number of impressions, time to duplicate the job on the 5090 versus the DocuTech, quality of output, and difficulty level in duplicating the specific job) with respect to the jobs being duplicated on the DocuTech. Debbie Mitchell mentioned that proper training from Xerox should be performed off site rather than on site. An example is the on-site extended storage training which have taken 8 hours, of which only 1.5 hours were spend. A call to Xerox sales staff, Karen Murphy, voicing this concern was made by Dick Tuey who indicated that she would take care of any issues regarding the training.

Oct 94

The November 2, 1994 benchmark for the DocuTech/XDOD has been delayed to November 16, 1994 due to problems associated with communications to the DocuTech and XDOD servers. Since early October 1994, Xerox staff and GSFC staff have been attempting to resolve the communication problems. On October 24, 1994, Dick Tuey was able to communicate with the DocuTech Print Server. A file was sent to the Print Server, however, it did not appear to have received the file as there was no indication that it had been received as it did not appear in the subdirectory as a file. A call to Steve Witty, GSFC service desk on October 24, 1994 indicated that it appears that the communication problem has not been resolved. Xerox staff, Karen Murphy has setup a meeting with all appropriate Xerox personnel to resolve all expectations for a working DocuTech/XDOD system on October 28, 1994.

On October 25, 1994, Dick Tuey was successful in sending (File Transfer Protocol (FTP)) a 4.5-megabyte file to the Xerox Print Server from his personal computer (PC) work station which took approximately 2.3 minutes. The transfer rate varied from 32 to 35 kilobytes per second. Attempts at sending a file to the XDOD work station has so far been unsuccessful. At about 3:30 p.m., the same day, Dick Tuey successfully transmitted a file to the XDOD work station; however, he could not view the receipt of the file by XDOD. This confirmation was provided by the Xerox technician at a PC work station who could view the files on the XDOD workstation. The Xerox technician is in the process of resolving the viewing problems and hope to have all communication problems with the XDOD work station resolved by October 26, 1994.

As of October 28, 1994, 7:22 a.m., Dick Tuey had not been able to successfully communicate with XDOD; however, a successful transfer of a 3-megabyte file to the DocuTech was successful. On October 28, 1994, Xerox staff (Hermine Thompson, Karen Murphy, Scott Friedlander, Linda Dickerson, and Collin Nichols) and Headquarters staff met on November 16, 1994, to resolve issues regarding the requirements envisioned for the XDOD and benchmarking of the DocuTech. During the meeting, it was concluded that the XDOD software needed to be reloaded, since it might have been corrupted after so many patches and modifications to the XDOD software to enable it to communicate with Dick Tuey's PC. At 2:00 p.m. that day, Debbie Mitchell, DocuTech operator, had printed the four Postscript print files transferred directly to the DocuTech's print server from Dick Tuey's PC.

Oct 94           As of October 31, 1994, 9:30 a.m., the XDOD was not operating. Coordination with Steve Witty, GSFC Service Desk staff, indicated that Steve could not get into Windows; the system is currently locked. A call to Xerox, Karen Murphy, was made at 9:40 a.m. to alert her of the problem with the XDOD system at GSFC.

Nov 94           On November 2, 1994, Dick Tuey attempted to logged in to the DocuTech and was not able to connect. On November 3, 1994, Dick Tuey successfully logged in to the DocuTech at 7:55 a.m. At 7:58 a.m., the same date, Dick Tuey attempted to logged in to the XDOD, first using xdod.gsfc.nasa.gov and next using 128.183.32.194 as the IP addressess. Neither IP was successful.

On November 14, 1994, Dick Tuey received an outline of the benchmark tests from Ms. Mary Collins for DocuTech and XDOD to be conducted on November 16, 1994. An attempt at transferring files from Dick Tuey's PC work station was not successful.

On November 15, 1994, at 6:15 a.m., Dick Tuey was successful in completely transferring 4 files from his PC work station to the XDOD client/server. A complete log showing the FTP transactions was printed out to document the transfer, plus a screen dump of before and after the transfer.

On November 16, 1994, at 6:23 a.m., Dick Tuey successfully transferred 4-files from his PC work station to the XDOD client/server. A FTP log for this transfer is documented in appendix 4. The official benchmark for the Xerox DocuTech and XDOD systems began at 8:30 a.m. and ended with a printout of the production statistics by the DocuTech at 4:45 p.m. In attendance were

DocuTech:       Xerox staff - Mr. Collin Nichols, Ms. Hermina Thompson, Ms. Karen Murphy, Ms. Angie Howe, Mr. Scott Friedlander, Mr. Dave Daniels, and Ms. Linda Dickerson.

Operator - Ms. Debra Mitchell

NASA staff - Mr. Bob Lane and Mr. Dick Tuey

XDOD:           Xerox staff - Ms. Hermina Thompson, Ms. Karen Murphy, and Ms. Angie Howe, Mr. Dave Daniels

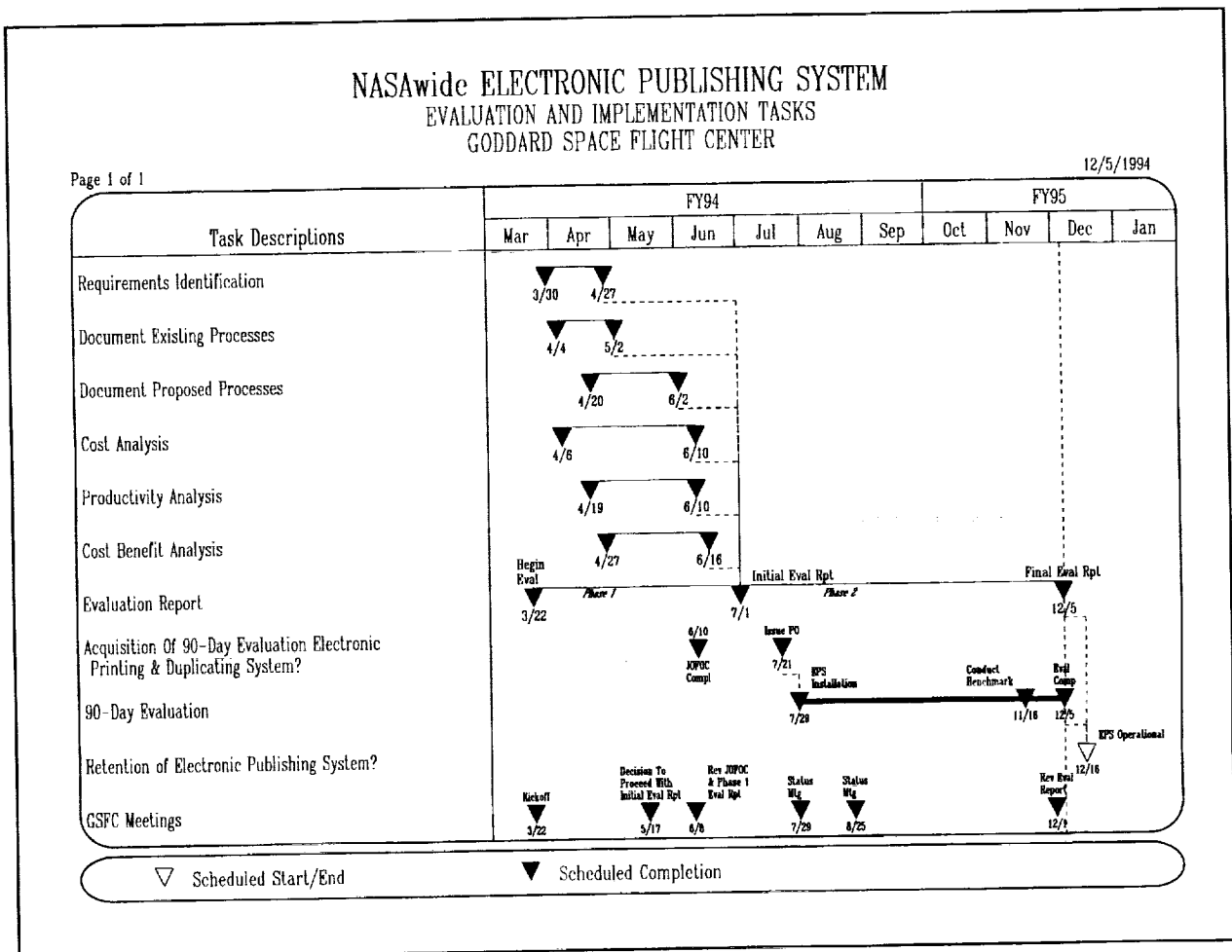
Operator - Mr. Steve Witty

NASA staff - Ms. Susan Hart

Mr. Tuey with assistance from Mr. Lane prepared the documentation for the DocuTech benchmark. Ms. Hart prepared the documentation for the XDOD benchmark. Xerox staff were available to assist in case there were any major operational problems with the DocuTech or XDOD systems, none were encountered. Operators for the DocuTech and XDOD performed all functions without direct assistance by the Xerox staff.

## Evaluation Schedule

Figure 3 shows an overall phasing schedule for the completion of the cost benefit analysis in support of a delivery of an evaluation system to validate the cost benefit analysis. The delivery, installation, benchmark, and determination on the retention of the electronic duplicating system are portrayed in the milestone schedule.



**Figure 3. Evaluation phasing schedule.**

## Printing and Duplicating Requirements

The minimum printing and duplicating requirements for the electronic printing and duplicating system must meet the following requirements:

1. The ability to receive electronic files concurrently with the scanning of hard copy.
2. Capacity to print greater than 100 pages per minute.
3. Resolution of 600 dots per inch (dpi).
4. Tape binding.
5. Saddle stitching (8.5- x 11-inch page and 5.5- x 11-inch page).



6. Stapling (single and dual stitching).
7. Electronic media (Diskettes, Local Area Network (LAN), Wide Area Network (WAN), Internet).
8. The merging of preprinted covers (8.5- x 11-inch cover and 5.5- x 11-inch cover).
9. Printing of address label or image to designated location on any page of a job.
10. Extended storage.
11. Accounting by organization to allow cost recovery.
12. Printing on demand from authorized points within GSFC.
13. Storing, accessing, and printing documents on demand.

### Storage and Communication Requirements

The optical disk capacity for a Write Once Read Many (WORM) or Rewriteable (5.25-inch disk) at 600 dpi with a 10:1 compression is calculated as follows:

1. An 8.5- x 11-inch page = 93.5 square inches.
2. Black text on white background.
3. Superior quality reproduction, 600 dpi (pixels).
4. A 5.25-inch disk = 650 MB (megabytes).
5. Scanning at 600 dpi = 360,000 bits per square inch.
6. One page, no compression,  $93.5 \times 360,000 = 33,660,000$  bits.
7. Therefore, 33,660,000 bits divided by 8 = 4,207,500 (4.208 MB) bytes on one page.
8. Given a 5.25-inch disk, 650 MB divided by 4.208 MB = 154.5 pages.
9.  $154.5 \times$  compression ratio of 10 = 1,545 pages per 5.25-inch disk.
10. Total number of pages divided by 1,545 = 'X' number of 5.25-inch disks needed.
11. Assuming an average number of pages per publication = 20 pages.
12. Average number of publications per disk = 1,545 divided by 20 = 77.24 publications.

Typically, the number of pages stored on an optical disk will vary based on variation in the density of the information on a page. The number will also depend on the resolution of the raster image, measured in dots per inch as calculated above. For planning purposes, Xerox's<sup>1</sup> experience with their documents on demand system has shown that the amount of disk space required for a 600-dpi scanned page is approximately 190 kilobytes (KB) with  $\pm 25$  KB. Optimally, a 650-MB disk could hold 650 MB divided by 190 KB/page @ 600 dpi = 3,400 pages or 3,400 divided by 20 = 170 publications.

During the phase-2 evaluation cycle, the proposed configuration (disk storage) for the mastering and accessing of technical publications will be validated through actual usage but, at present, is more than adequate to cover the 90-day evaluation using the more conservative calculation of 77.24 publications stored per disk. Projected sizing and performance requirements will be analyzed via the use of simulation techniques.

The estimated cost of a single magneto-optical storage disk (5.25-inch) is \$250 each or \$1,750 per box of ten disks. The cost per storage of a single 20-page publication would come to

\$250 per disk divided by 170 publications = \$1.47 per publication, or conservatively  
 \$250 per disk divided by 77.24 publications = \$3.24 per publication.

The storage of publications such as forms, handbooks, brochures, and TMs for later usage requires

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<sup>1</sup>References, Number 4

physical space. For example, the warehouse for NASA Headquarters has a cost of \$18.18 per square foot fully loaded. Specifically, this cost consists of the following breakdown:

1.	Lease of Space	\$ 9.45 per sq ft
2.	Contract Expenses	\$ 8.14 per sq ft
3.	Overhead	<u>\$ .59 per sq ft</u>
	Total Cost	\$18.18 per sq ft

Given the cost per square foot, it can be estimated that the storage of 100 copies of a 20-page document would come to approximately \$9.45 divided by 100 = \$ 0.0945 per copy. Since the publication would need to be identified and stored by some unique identification number, the physical space would be the same, regardless of the quantity of the same publication. Therefore, the cost for the storage of the publication would increase as the quantity of publications went down.

The communication capacity will vary according to the quality, speed, and bandwidth at the Goddard Space Flight Center. In calculating the response time, the following table<sup>2</sup> provides the quality versus speed versus bandwidth for each page (8.5 x 11 inch or 400 words @ 200 dpi estimated @ 50 KB with a 10:1 compression ratio) being transferred or accessed over the Internet.

Quality (dpi)	Page (Bytes/Bits)	Bandwidth		
		1 Channel	24 Channels	672 Channels
		<u>64 Kbps</u>	<u>1.5 Mbps/T1</u>	<u>44.7 Mbps/T3</u>
200	50 K/400 K	6.25 sec.	0.27 sec.	0.01 sec.
300	106 K/850 K	13.3 sec.	0.57 sec.	0.02 sec.
400	190 K/1.5 M	23.4 sec.	1.00 sec.	0.34 sec.
600	TBD	TBD	TBD	TBD

Using the above table, the transmission of a 20-page publication @ 400 dpi would take approximately

1. 23.4 sec, at 64 Kilo bits per second (Kbps), times 20 = 468 seconds or 7.8 minutes.
2. 1.0 sec, at 1.5 Mega bits per second (Mbps), times 20 = 20 seconds.
3. 0.34 sec, at 44.7 Mbps, times 20 = 6.8 seconds.

During the phase-2 evaluation cycle, the validation of the timing @ 600 dpi (request to receipt) for selected publications will be undertaken and documented.

The cost for the mailing of a 20-page publication via the U.S. Postal Service within the United States comes to

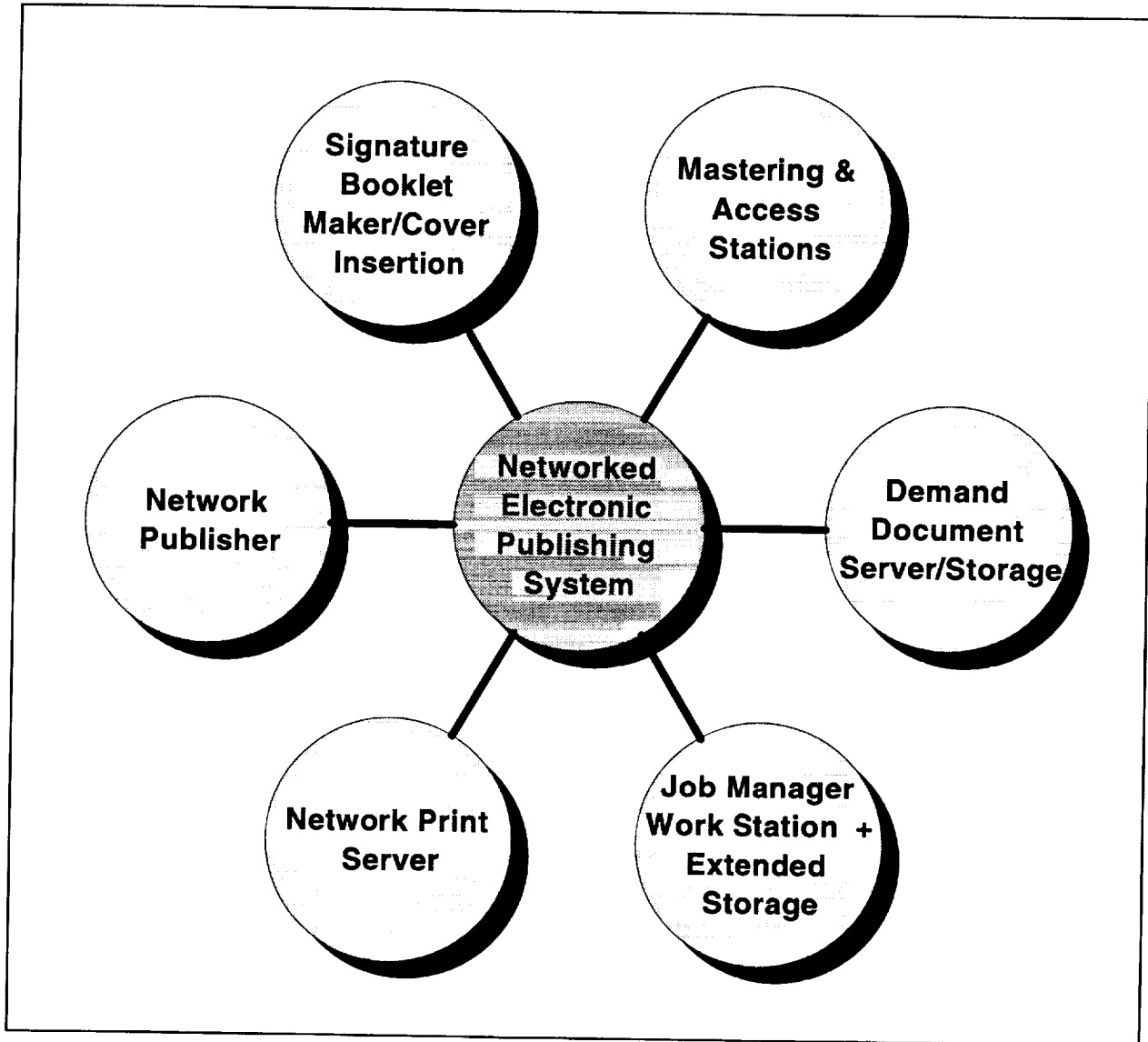
- |    |              |           |  |
|----|--------------|-----------|--|
| 1. | First Class  | = \$ 1.44 | 1 to 3 days' transit (1 day within city, 2 days within 600 miles, 3 days greater than 600 miles) |
| 2. | Fourth Class | = \$ 1.21 | 2 weeks' transit   |
| 3. | Overnight    | = \$ 9.95 | 12 hours' transit  |

### Electronic Publishing System Configuration

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<sup>2</sup>References, Number 5

The proposed networked electronic publishing system which will meet the requirements cited above is displayed by Figures 4 and 5. Figure 5 provides an overview of the electronic publishing system network logical architecture, identifying a technical publication work group within a NASA center for transforming paper masters into digital image files, structuring them into electronic documents, indexing and storing them into a digital document base, and providing software tools for electronic access and viewing with the provision to prepare a job ticket for printing and reprinting them on demand via the networked duplicating work group within a NASA center.



**Figure 4. Networked electronic publishing system components.**

Figure 5 displays the hardware and communication interfaces between the NASA centers, work groups and access by the multiple client (user) platforms. Users can review their technical publications on the technical publication work group document server before submitting a job ticket to the duplicating work group for printing on demand by the networked DocuTech.

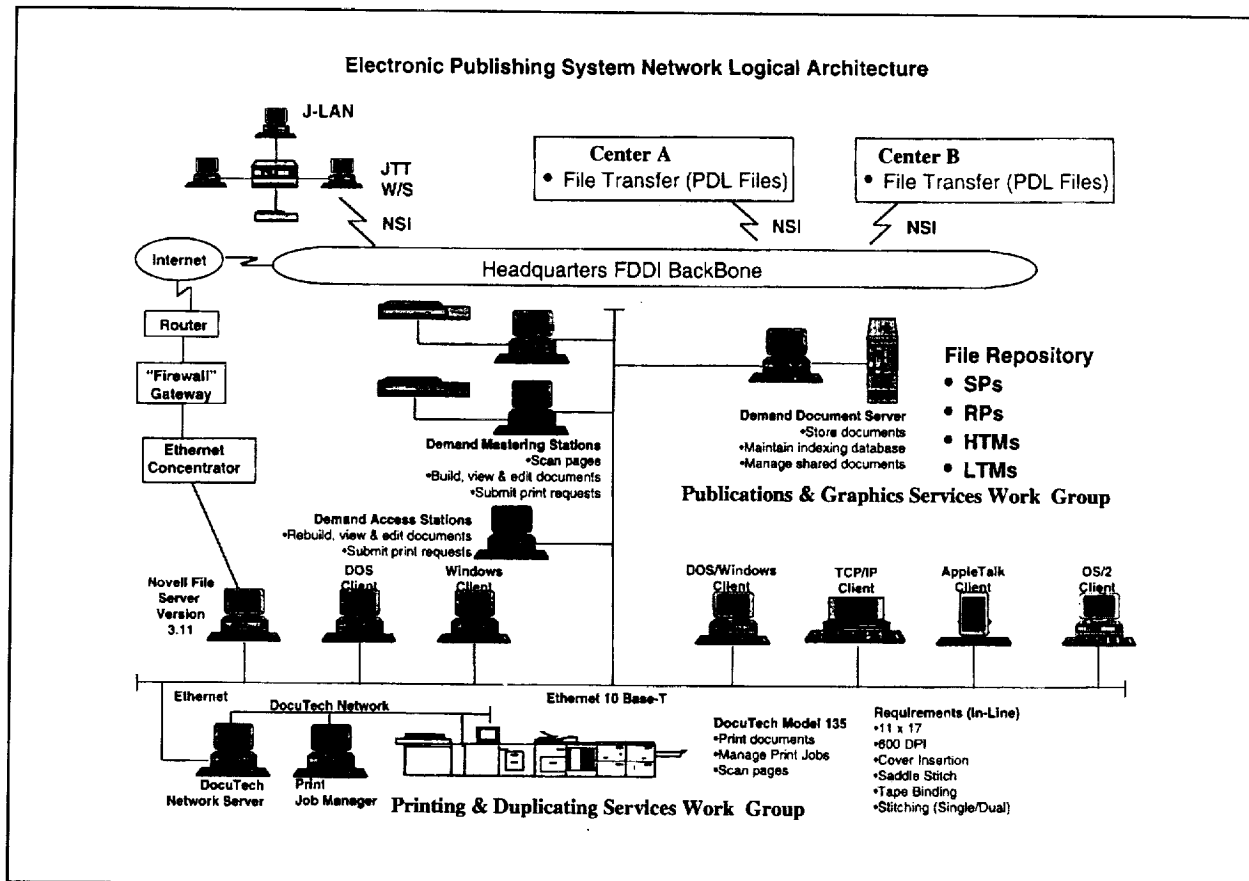
Specific components of the technical publication work group consist of

1. Mastering (Capture) Station
  - a. PC 486/33 with 16MB ram
  - b. 1.05 GB hard drive
  - c. 3.5" 1.44 MB floppy
  - d. 5.25" 1.2 MB floppy
  - e. Serial mouse
  - f. Monitor
  - g. Ethernet controller card
  - h. Interface card
2. Scanner
  - a. 600 dpi
  - b. Automatic document handler
  - c. 20 pages per minute
  - d. Up to 11- x 17-inch sheets
3. Document Server
  - a. Sparc System 10 with 48MB ram
  - b. 424 MB disk drive
  - c. 1.05 GB SCSI-2 drive
  - d. Sun CD ROM reader
  - e. 3.5" floppy drive
  - f. Monitor
  - g. SBUS SCSI-2 ethernet card
4. Laser Printer With 2MB Memory
5. Integrated Software
  - a. Xerox document management services
  - b. Xerox distributed imaging services
  - c. MS Windows
  - d. MS DOS
  - e. Gupta SQLBase for Windows
  - f. Beame & Whiteside TCP/IP communications
  - g. Xerox document server software
  - h. Sun OS Software
  - i. Gupta SQLBase for Unix

Specific components of the networked duplicating work group consist of

1. DocuTech Network Production Publisher NP 135B
2. Network Printer Server
3. Network Print Server Job Manager
4. Signature Booklet Maker

5. Covers Insertion Module
6. Extended Storage
7. Integrated Software
  - a. Xerox DocuTech
  - b. MAC 5 Netware
  - c. TCP/IP Network



**Figure 5. EPS network logical architecture.**

### Existing Processes

Figure 6 represents a general flow diagram of the process steps by a user in duplicating a publication. The upper half of the figure identifies the steps for duplicating via the Xerox 5090, and the lower half identifies the steps for printing a publication when it is submitted to GPO. The duplicating requirement for the steps presented is identified in the upper right corner of Figure 6.

Specific steps are documented and presented as Figures 7 (general description) and 8 (Director's Weekly). Each figure describes the steps required to produce the document, the total time for each step, general comments about the step, and functional position of the staff person performing the step in question (e.g., SDT for service desk technician and PS for printing specialist). The processing time has been provided as a total number from submission of the publication to its delivery to the customer.

Under the cost per copy program, the duplicating machines are located at the specific user site and are charged according to usage.

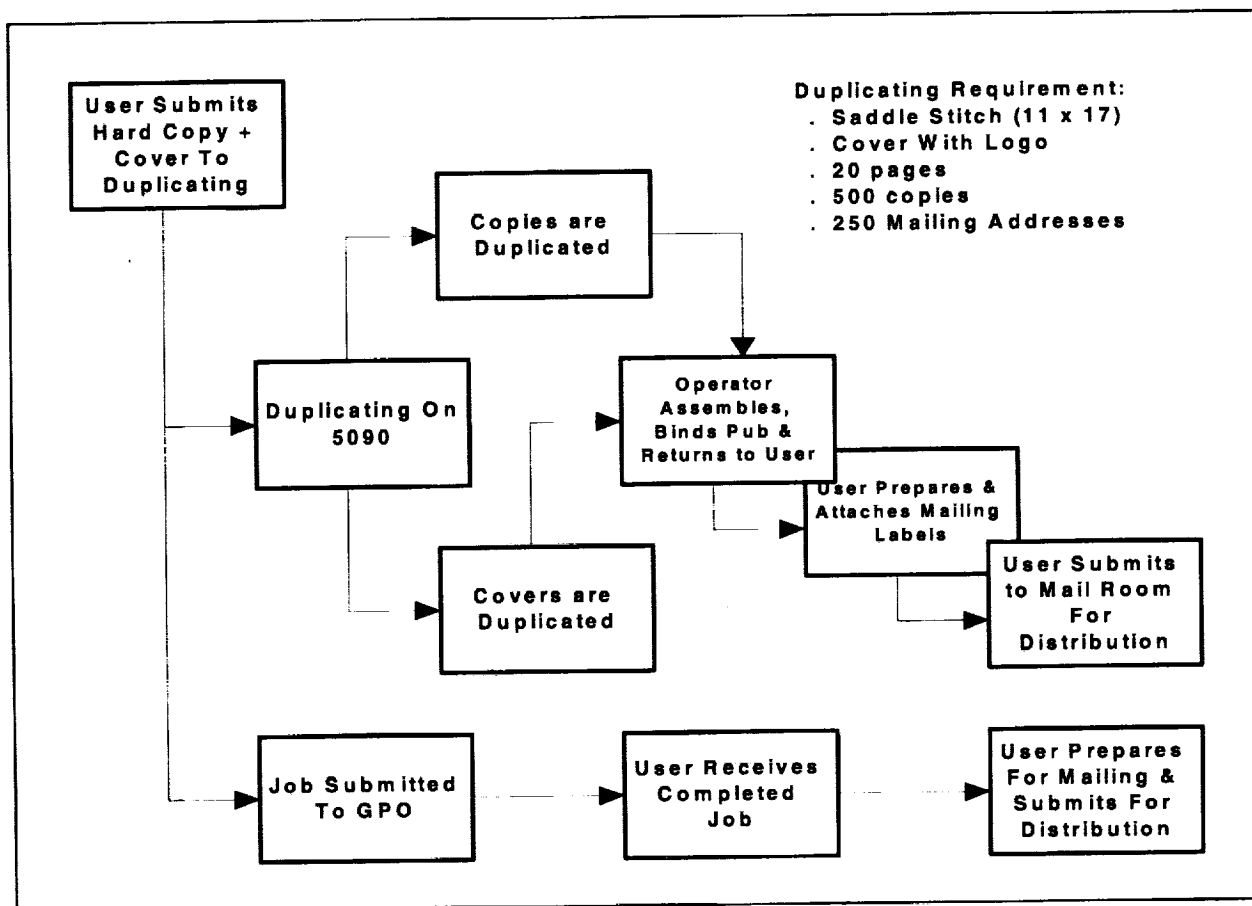


Figure 6. Duplicating process.

In determining the recovery of costs for the 90-day evaluation, a review of the GSFC's Printing Management Office Fiscal Year Report of Contract Printing, dated April 15, 1994, was made. Out of the many jobs listed in the report, a selection of eight jobs or five application categories was made. These eight jobs formulated the basis for full cost recovery of the evaluation. During the phase-2 or the 90-day evaluation cycle, there is no limit on the amount of duplicating done on the networked DocuTech; therefore, it can be assumed that the cost recovery will be more than adequate to cover the evaluation costs.

As described in the preceding paragraph, the eight jobs are further broken down into a matrix of key document characteristics. The matrix (Figure 9) identifies, by each job, the application category type, size of the document (8.5 x 11, 11 x 17, 5.5 x 8.5), type of finishing, the document content (text, line art, graphics, halftone), the number of pages, the frequency (weekly, monthly, bimonthly, biyearly, quarterly), and the total annual volume.

Coinciding with the key document characteristics, a second matrix (Figure 10) identifies, by each job, the amount of time (elapsed and actual time spent) by functional position in delivery of a final product for a customer from submission to its receipt.

**Department/Work Group: Printing and Duplicating Services Section**  
**Name of Key Document: General Description**

Step No.	Steps Required to Produce the Key Document	Total Time	Comments	Functional Position
1	Customers submit one of the following job requests: GSFC 25-11 Printing & Duplicating Request GSFC 25-33 Publications Request GSFC 25-5 Presentation & Graphics Request GSFC 25-7 Still Photography Request	5-10 m	The GSFC 25-11 Printing & Duplicating Request Jobs are the primary focus of this analysis.	Service Desk Technician (SDT) & Customer
2	The job request is entered into the Management Information Cost Tracking System (MICTS). An Information Management Division (IMD) Number is assigned, and available funding is noted on the request.	5 m		SDT
3	The job requirements are reviewed to determine how the job will be processed.	3-5 m	The following printing sources are considered: o Printed by the Service Desk personnel on Minolta EP8602 or Canon Color Copier o Sent to Bldg 16W to be printed on Xerox 5090 Copier o Sent to Outside Contractor	SDT
4	The customer is redirected to a printing specialist if it is determined that the job cannot be processed by the Service Desk or Bldg 16W.	1 m		SDT
5	Job requirements are reviewed for clarification with the customer.	5-20 m	Time depends on customer's understanding of job requirements; suggestions are often requested by customer.	Printing Specialist (PS)
6	Contractor is identified to process the job.	2-10 m	Contractor's ability to accept the job or to support special requirements sometimes depends on workload, which can affect turnaround time.	PS
7	The job is entered into the JTX cost analysis program, and funding is allocated.	5 m		PS
8	Seven copies of the 25-11 are printed and distributed.	5-10 m		PS
9	The contracting courier picks up the jobs twice daily from the outgoing box for processing.	4 hours		Contracting Courier
10	The contracting courier returns the completed job to the requester, the warehouse, or the mail room.	3-5 days	There is a 3 - 5 day turnaround time; however, much of the work is returned completed the following day. (Time represented in the Total Processing Time is 24 hours)	Contractor
11	Mail room personnel generate labels.	15 m		Mail Room Clerk
12	Labels are manually affixed to each copy.	30 m - 4 hours	Time depends on the size of the job.	Mail Room Clerk
13	Copies of the job are sorted by distribution destination for courier pickup or US Mail pickup.	1 hour	Time depends on the size of the job.	Mail Room Clerk
14	Courier picks up the mail and delivers to each building.	2-4 hrs		GSFC Transportation Driver

Total Processing Time: 3 - 5 Days 13:21 Minutes

**Figure 7. General description of current process.**

<b>Department/Work Group: Printing and Duplicating Services Section</b> <b>Name of Key Document: Director's Weekly</b>				
Step No.	Steps Required to Produce the Key Document	Total Time	Comments	Functional Position
1	Each Code submits its input on Wednesday.	6.5 hrs	All submissions are due weekly on Wednesday (electronically due 12:00; hard copy 2:00).	Service Desk Technician (SDT)
2	Archives Code submissions from the previous week.	5 m		SDT
3	Reviews and imports submissions for the current week into a working file.	5-20 m	Time is based on how many codes submit input for the week.	SDT
4	Validates Information.	3 m		SDT
5	Runs a test print to local network laser printer.	30-40 m	Time depends on length of each submission.	SDT
6	Makes format edits only if required.	30-40 m	Time depends on number of formatting errors.	SDT
7	Reprints entire report if required.	1 hr	Time depends on number and length of submission.	SDT
8	Electronically sends confirmation notices to the Codes after 2:00 on Wednesday.	5-10 m		SDT
9	Manually assembles all hard copy submission in numerical order by code.	10-20 m	Time depends on number of manual submissions.	SDT
10	Automatically enters the electronic submissions from the codes into an index. Manually registers the copy submissions.	5 m		SDT
11	Prints the indexed organization chart and places it on top of the week's submissions.	5-10 m		SDT
12	Blue numbers the pages on the back.	13-15 m		SDT
13	Completes a GSFC 25-11 and gives the package to a printing specialist.	3 m		SDT
14	Reviews the job for completeness and places a cover on top of the package.	3-20 m	Time depends on job complexity.	Printing Specialist (PS)
15	Enters the job into the JTX cost analysis program, and allocates funding.	5 m		PS
16	Prints and distributes seven (7) copies of the 25-11.	5-10 m		PS
17	The contracting courier picks up the jobs twice daily from the outgoing box for processing.	4 hr		Contracting Courier
18	The contracting courier returns the completed job to the requester, the warehouse, or the mail room.	3-5 days	There is a 3 - 5 day turnaround time; however, much of the work is returned completed the following day. (Time represented in the Total Processing Time is 24 hours).	Contractor
19	Mail room personnel generate labels.	15 m		Mail Room Clerk
20	Affixes the labels manually to each copy.	30 m - 4 hrs	Time depends on the size of the job.	Mail Room Clerk
21	Sorts copies of the job by distribution destination for courier pickup or US Mail pickup.	1 hr	Time depends on the size of the job.	Mail Room Clerk
22	Courier picks up the mail and delivers to each building.	2-4 hrs		GSFC Courier
Total Processing Time: 47:37 hours				

**Figure 8. Director's Weekly current process.**



NASA Goddard Printing and Duplicating Services Section							
Selected Key Document Characteristics Analysis							
Job Title	Application Category	Size	Finishing	Document Content	Volume	Frequency	Annual Volume Estimates
Director's Weekly	Booklet	8.5 x 11	Dual Stitch	Text , Line Art	46,500	Weekly	2,418,000
Goddard Weekly	Booklet	8.5 x 11	Dual Stitch	Text, Line Art	41,385	Weekly	2,152,070
GEWA Newsletter	Newsletter	11 x 17	Fold	Text, Line Art	44,000	Monthly	2,288,000
Goddard Newsletter	Newsletter	11 x 17	Saddle Stitch	Text, Graphics, Line Art, Halftone	100,000	Monthly	1,200,000
NSSDC Newsletter	Newsletter	11 x 17	Saddle Stitch	Text, Graphics, Line Art, Halftone	20,000	Monthly	240,000
NASA Technical Memorandum	Booklet	11 x 17	Saddle Stitch, Thermal Bound, GBC Bind, Three Hole	Text, Graphics, Line Art, Halftone	13,390	Bi-Monthly	321,360
GSFC 17-92 Request for Training Form	Form	8.5 x 11	Multipart Carbonless Form Paper	Text, Line Art	10,000	6 Months	20,000
1994 GSFC Honor Awards	Pamphlet	5.5 x 8.5	Saddle Stitch	Text, Graphics, Line Art, Halftone	17,200	Quarterly	68,800
Request for Proposals	Book	8.5 x 11	3 Hole Punch	Text, Graphics	103,853	Monthly	1,246,240
HST	Document	8.5 x 11	Single Stitch	Text	4,638	Monthly	55,650
SF-2080	Form	8.5 x 11	Multipart	Text, Line Art	9,725	Monthly	116,700
Direct, Discr.	Document	8.5 x 11	Single Stitch	Text, Graphics	2,771	Monthly	33,250
FY 94 OMPT	Document	8.5 x 11	Single Stitch	Text, Graphics	5,146	Monthly	61,760
Project Plans	Document	8.5 x 11	Dual Stitch	Text, Graphics	4,250	Monthly	51,000
EOS	Document	8.5 x 11	Single Stitch	Text	4,250	Monthly	51,000
NASA Newsletter	Newsletter	11 x 17	Saddle Stitch	Text, Graphics, Line Art, Halftone	13,520	Monthly	162,240
XRONOS	Book , Pamphlet	8.5 x 11 11 x 17	Single Stitch Double Stitch	Text, Graphics	14,125	Monthly	169,500
Legacy	Book , Pamphlet	8.5 x 11 11 x 17	Single Stitch Double Stitch	Text, Graphics	19,167	Monthly	230,000
Total							9,225,520

**Figure 9. Document characteristics.**

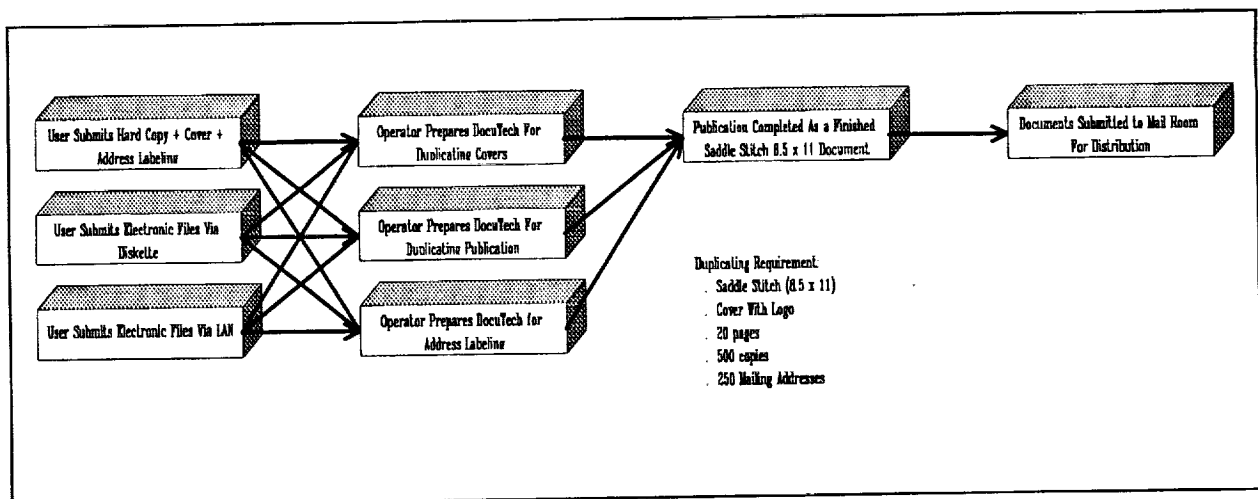
Key Document Handling Matrix (by Functional Position)									
Key Document Title	Service Desk Technician	Printing Specialist	Contractor Courier	Contractor	Mail Room Clerk	GSFC Transportation Courier	Warehouse Support	Publication Archive	Total
Director's Weekly	6.5h	35m	4h	3-5d	3h	4h	1h	0	3-5d 18:26h
Goddard Weekly	6.5h	35m	4h	3-5d	5:15h	4h	1h	0	3-5d 18:26h
GEWA Newsletter	15m	35m	4h	1d	5:15h	4h	1h	0	1d 15:05h
Goddard News	15m	1:30h	4h	5+d	5h	4h	1h	0	5+d 15:45h
NSSDC News	15m	1:30h	4h	5+d	5h	4h	1h	0	5+d 15:45h
NASA Technical Memorandum	15m	1h	4h	5+d	3h	4h	1h	30m	5+d 13:45h
GSFC 17-92 Request for Training Form	10m	35m	4h	5d	0	4h	1h	10m	5d 9:55h
1994 GSFC Honor Awards	10m	1h	4h	5+d	0	4h	1h	0	5d 10:10h
Total	15:02h	6:20h	40h	32:33d	26:30h	40h	8h	40m	32-38d 15:32h

**Figure 10. Elapse time (current process).**

Legend: m = minutes, h = hours, d = days

### Proposed Processes

Generally, the electronic duplicating process steps are shown by Figure 11 and are described by the section on "Proposed Process."



**Figure 11. DocuTech process steps.**

With the networked production DocuTech, the user has three alternatives in the submission of the publication. The first, as has been followed in the past, is to submit the publication in hard copy form to be duplicated in house on the Xerox 5090 or on the on-site duplicating machine (cost per copy); the second is to submit the publication on a diskette; and the third is to electronically transmit the publication to the networked DocuTech's print server. Assuming that a list of mailing addresses is submitted with the publication, these addresses will be merged with each publication. The final result is a finished publication to be picked up by a mail room clerk for distribution.

In analyzing each of the jobs destined to be duplicated on the networked production DocuTech, Figure 12 displays, in matrix form, the estimated time that each job will take. This total processing time is determined by the operator who first analyzes the job and sets up (programs) the DocuTech. Essential steps in the process are to scan originals, to make program adjustments, to set up paper trays, to run proof copy, to perform image editing, to print the job, and to set up the booklet maker as appropriate for a 5.5" x 8.5" saddle stitch booklet.

Figures 13 and 14 provide a step-by-step analysis of the proposed process (general description and Director's Weekly) by laying out in matrix format the job sequence: a description of the steps required to produce the document within the job sequence, the functional position required to perform the job sequence, and the original time and proposed time for the job sequence. Time- and cost-saving opportunities are flagged by an "X" for the specific job sequence in the matrix.

The concurrency capability of the Xerox DocuTech Production Publisher allows multiple jobs to be in progress on the system at the same time. Key considerations are that the originals are only scanned once; a job can be printing while the next job is being scanned; jobs can be sent via the network while printing, scanning, or programming a job; jobs can be sent via floppy disk while receiving from the network, or printing, scanning, or programming a job; jobs can be stored on the system for printing later; printing and scanning can be interrupted to print another job and resume with original job when finished; and finally, paper stock can be replenished while the system is still printing.

DocuTech Production Publisher Process Analysis									
Key Document Title	Analyze & Program	Scan Originals	Program Adjustment	Set Up Paper Trays	Run Proof	Image Editing	Print Job	Set Up Booklet Maker	Total Processing
Director's Weekly	5m	5m	5m	3m	1m	0	5h	0	5:24h
Goddard Weekly	5m	4m	5m	3m	5m	0	5h	0	5:18h
GEWA Newsletter	5m	1m	5m	3m	1m	0	5:43h	0	5:27h
Goddard News	5m	1m	30m	3m	1m	3m	12:30h	0	13:13h
NSSDC News	5m	1m	30m	3m	1m	3m	4h	0	4:43h
NASA Technical Memorandum	5m	5m	20m	3m	1m	1m	2h	0	2:35h
GSFC 17092 Request for Training Form	5m	1m	5m	3m	1m	0	7:40h	0	7:55h
1994 GSFC Honor Awards	5m	1m	1h	3m	1m	3m	2:15h	1h	3:28h

Figure 12. DocuTech processing time.

Legend: m = minutes, h = hours

<b>Department/Work Group: Printing and Duplicating Services Section</b> <b>Name of Key Document: General Description</b>						
Step No.	Steps Required to Produce the Key Document	Functional Position	Before Time	After Time	Time Saving Opportunities	Cost Saving Opportunities
1	Customers submit one of the following job requests:  GSFC 25-11 Printing & Duplicating Request GSFC 25-33 Publications Request GSFC 25-5 Presentation & Graphics Request GSFC 25-7 Still Photography Request	Service Desk Technician (SDT) & Customer	5-10 m	5-10 m		
2	The job request is entered into the Management Information Cost Tracking System (MICTS). An IMD Number is assigned, and available funding is noted on the request.	SDT	5 m	5 m		
3	The job requirements are reviewed to determine how the job will be processed.	SDT	3-5 m	3-5 m		
4	The customer is redirected to a printing specialist if it is determined that the job cannot be processed by the Service Desk or Bldg 16W.	SDT	1 m	1 m		
5	Job requirements are reviewed for clarification with the customer.	Printing Specialist (PS)	5-20 m	5-20 m		
6	Contractor is identified to process the job.	PS	2-10 m	2-10 m		
7	The job is entered into the JTX cost analysis program and funding is allocated.	PS	5 m	5 m		
8	Seven copies of the 25-11 are printed and distributed.	PS	5-10 m	5-10 m		
9	The contracting courier picks up the jobs twice daily from the outgoing box for processing.	Contracting Courier	4 hours	4 hours		
10	The contracting courier returns the completed job to the requester, the warehouse, or the mail room.	Contractor	3-5 days	2-8 hrs	X	X
11	Mail room personnel generate labels.	Mail Room Clerk	15 m	0	X	X
12	Labels are manually affixed to each copy.	Mail Room Clerk	30 m - 4 hours	0	X	X
13	Copies of the job are sorted by distribution destination for courier pickup or US Mail pickup.	Mail Room Clerk	1 hour	1 hour		
14	Courier picks up the mail and delivers to each building.	GSFC Transportation Driver	2-4 hrs	2-4 hrs		
Total Processing Time: 3 - 5 Days 13:21 Minutes						

**Figure 13. General description (process comparisons).**

<b>Department/Work Group: Printing and Duplicating Services Section</b> <b>Name of Key Document: Director's Weekly</b>						
Step No.	Steps Required to Produce the Key Document	Functional Position	Before Time	After Time	Time Saving Opportunities	Cost Saving Opportunities
1	Each Code submits its input on Wednesday.	Service Desk Technician (SDT)	6.5 hrs	6.5 hrs	X	X
2	Archives Code submissions from the previous week.	SDT	5 m	5 m	X	X
3	Reviews and imports submissions for the current week into a working file.	SDT	5-20 m	5-20 m		
4	Validates Information.	SDT	3 m	3 m		
5	Runs a test print to local network laser printer.	SDT	30-40 m	30-40 m	X	X
6	Makes format edits only if required.	SDT	30-40 m	30-40 m	X	X
7	Reprints entire report if required.	SDT	1 hr	1 hr	X	X
8	Electronically sends confirmation notices to the Codes after 2:00 on Wednesday.	SDT	5-10 m	5-10 m		
9	Manually assembles all hard copy submission in numerical order by code.	SDT	10-20 m	10-20 m		
10	Automatically enters the electronic submissions from the codes into an index. Manually registers the copy submissions.	SDT	5 m	5 m		
11	Prints the indexed organization chart and places it on top of the week's submissions.	SDT	5-10 m	5-10 m		
12	Blue numbers the pages on the back.	SDT	13-15 m	13-15 m		
13	Completes a GSFC 25-11 and gives the package to a printing specialist.	SDT	3 m	3 m		
14	Reviews the job for completeness and places a cover on top of the package.	Printing Specialist (PS)	3-20 m	3-20 m	X	X
15	Enters the job into the Job Tracking System (JTX) cost analysis program, and allocates funding.	PS	5 m	5 m		
16	Prints and distributes seven (7) copies of the 25-11.	PS	5-10 m	5-10 m		
17	The contracting courier picks up the jobs twice daily from the outgoing box for processing.	Contracting Courier	4 hr	4 hr	X	X
18	The contracting courier returns the completed job to the requester, the warehouse, or the mail room.	Contractor	3-5 days	3-2 days	X	X
19	Mail Room personnel generate labels.	Mail Room Clerk	15 m	0	X	X
20	Affixes the labels manually to each copy.	Mail Room Clerk	30 m - 4 hrs	0	X	X
21	Sorts copies of the job by distribution destination for courier pickup or US Mail pickup.	Mail Room Clerk	1 hr	1 hr		
22	Courier picks up the mail and delivers to each building.	GSFC Courier	2-4 hrs	2-4 hrs		
Total Processing Time: 47:37 hours						

**Figure 14. Director's Weekly current process.**

## **Phase 1 - COMPARATIVE COST AND PRODUCTIVITY ANALYSIS**

### **Billing Rates for Electronic Publishing System Evaluation**

Figure 15 displays the cost algorithm for the networked DocuTech for full cost recovery for the phase-2 evaluation cycle. The production numbers match those identified by Figure 9 and, for the initial cost analysis purposes, represent those printing and duplicating jobs which can be transferred to the networked DocuTech Publisher system. As identified earlier, all duplicating work done on the 5090 during the benchmark will be done on the DocuTech, along with the cost recovery jobs during the 90-day evaluation.

### **Cost Analysis**

Figure 16 displays the basic costs for the networked DocuTech Publisher system during the phase-2 evaluation and the operational costs after the evaluation. Using 1.342 cents per page times the number of estimated yearly pages gives the total recovery costs during the phase-2 evaluation; Figure 15 displays the production profile required to break even. This monthly total of 616,965 impressions is derived directly from the total estimated impressions displayed in the upper (right corner) matrix portion of Figure 15 (Column M, Roll 3). In interpreting Figure 15, columns are represented by upper case letters and the rolls are represented by numeric numbers. The production profile is shown in Figure 9 where jobs of a similar nature can be categorized as Type 1, that is, Job 1, and so forth. A total of five application categories of jobs are displayed for this analysis.

Figure 17 provides a matrix of the estimated production volume to achieve a break-even point after the phase-2 evaluation. Until the actual production workload statistics are gathered, an estimated workload of 1,562,404 impressions is required to fully recover all costs for the networked DocuTech Publisher and Documents on Demand in its fully configured mode, reference Figure 17 (Column M, Roll 31). At this stage of the analysis, the cost algorithm for the networked DocuTech does not attempt to recover costs for staffing, space, or special training requirements for the system.

Figure 18 reflects all cost parameters and displays the 5-year cash outflow for four alternatives. The first alternative is printing through GPO commercial printing; the second alternative is duplicating through the cost per copy program, the third is duplicating through the use of the networked DocuTech Publisher without the Document On Demand module, and the fourth alternative is duplicating through the use of the networked DocuTech Publisher/Documents on Demand with all available features. As of July 1, 1994, the calculations presented in Figure 18 are not reflective of the potential costs for the system. This figure will be updated during the phase-2 evaluation cycle and the text changed accordingly.

Figure 18 also displays a comparison of the four alternatives over a 5-year cash-flow period. Supplemental analyses are displayed for each alternative, such as Net Present Value, Present Value, Average Cost Per Year, Average Cost Per Thousand, and the Benefit/Cost Ratio plus benefits of the highest alternative against the remaining three alternatives. Finally, identification of productivity gains is derived on a global basis with potential gains for the installation ranging from 0.5 to 6.0 percent. The average full time equivalent (FTE), including benefits, is calculated for all civil servants within the installation and, when determined, provides the potential cost avoidance when a networked DocuTech Publisher has been installed.

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Production Workload To Recover Monthly Evaluation Costs - Phase 1 Justification													M	
A	B	C	D	E	F	G	H	I	J	K	L	M		
Categories	Rate	Reorder Qty	Current Qty	CPM Reorder	Current Reorder	MSDC Reorder	MSDC TR	2000 17-32 Speed For Training Form	1994 CPM Reorder Insects	2000 Reorder From T164 CPO Rep	Costs	Avg Mthly Imp		
Total Impressions	11	46,500	41,395	44,000	100,000	20,000	13,390	60,000	17,200	NA	\$3,767.23	616,965		
1-Sided Prints	15	0	89	0	0	0	0	10,000	0	NA	\$151.34			
2-Sided Prints	20	50	0	0	0	0	0	0	2	NA	\$1.04			
11x17 Prints	25	0	0	2	4	6	54	0	0	NA	\$1.65			
11x17 Impressions	15	0	0	0	0	0	0	0	0	NA	\$0.00			
Single Print Jobs	15	0	0	0	0	0	0	0	0	NA	\$0.00			
Scans	30	102	92	4	8	10	103	6	4	NA	\$9.87			
Binds	200	0	0	0	0	0	0	0	0	NA	\$0.00			
Single Stitches	5	0	0	0	0	0	0	0	0	NA	\$0.00			
Dual Stitches	10	465	465	0	0	0	0	0	0	NA	\$9.30			
Total Booklets	24	0	0	0	0	0	0	0	0	NA	\$0.00			
11x17 Booklets	20	0	0	11,000	12,500	2,000	130	0	4,300	NA	\$598.60			
Weekly Cost	1	\$520.21	\$463.99	\$704.17	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	NA	\$1,688.36			
CPO/5090 Cost	NA	\$463.00	\$406.00	\$300.00	\$301.00	\$325.00	\$570.00	\$100.00	\$4,634.00	\$9,365.00				
Est 90 Day Eval Cost	NA	\$6,242.52	\$5,567.76	\$2,112.51	\$2,703.00	\$975.00	\$1,710.00	\$300.00	\$4,634.00	\$0.00	\$24,244.79			
Average Monthly Cost	4	\$2,080.84	\$1,855.92	\$704.17	\$1,350.34	\$260.45	\$154.33	\$810.18	\$275.36	\$9,365.00	\$16,876.59			
Average Annual Cost	12	\$27,050.92	\$24,126.96	\$8,450.04	\$16,204.08	\$3,125.40	\$3,703.92	\$1,820.36	\$1,101.44	\$112,820.00	\$199,003.12			
Est Annual Impressions		2,418,000	2,152,020	528,000	1,200,000	240,000	321,360	120,000	68,800	355,404	7,403,594			
Cost Per Impression		\$0.01119	\$0.01121	\$0.01600	\$0.01350	\$0.01302	\$0.01153	\$0.01350	\$0.01601	\$0.31688	\$0.02874			
#Jobs Annually		52	52	12	12	12	24	2	4	12	166			
Pages Per Pub		50	89	2	4	8	54	1	2	NA	30			
# Original Pages		2,600	4,628	24	48	96	1,296	2	8	5,000	13,702			
Cost Per Publication		\$1.12	\$1.00	\$0.06	\$0.11	\$0.13	\$1.19	\$0.08	\$0.06	NA	\$0.53			
Monthly Eval Costs =		\$5,965.00	\$7,491.59	\$0.00	\$9,365.00	\$0.00	\$7,405.63							
ROI =													1.38	

Figure 15. Phase-1 production profile.

A	B	C	D	E	F	G	H	I	J	K
GSA Contract GS25P-1001B, Period 10/1/83 to 9/30/88										
	Cost Item	Unit Price	90 Day Est. Charges	GSA Promotional Discount	One Time Purchases	JOP (60 Mlb) Factor = .021002	Monthly Maintenance	Charge/Copy (Supplies)	Total Monthly	DocuTech Productivity Measurement Standards
1	DocuTech Network Publishers With By-Pass Transport (HP-350) *	270,000	0	42,280	0	133,200		1,280.00		Impressions per minute
2	DocuTech Network Print Server, 1 gb (PG-1) Mod 3 & 4	34,000	862	6,900	27,040		294		294	Hourly Production
3	DocuTech Job Manager Workstation (JM-1) Mod 3 & 4	4,000	74	1,000	3,000		24		24	24 Daily Production (5 hrs daily)
4	Signature Booklet Maker Finisher - > 250,000 = .0022 (S3M1F)	50,000	1,178	6,500	41,500		382		382	Weekly Production
5	Cover Insertion Module (Works only with Signature Booklet Maker)	12,000	0	3,500	6,500					Monthly Production
6	S&I Labeling (Open Market)	5,000	0	0	5,000					Recommended MRP's Std
7	DocuTech Extended Storage (BSC-CL) Mod 5/Magneto Optical Drive (650 mb) (B7G)	42,000	857	8,865	33,135		245		245	750K - 1,000K
8	PCP TDP/TP Network (Open Market)	4,985	0	0	4,985					
9	JAN Manager	6,000	0	0	6,000					
10	Consulting Services & Technical Support	0	0	0	0					
11	Extended Warranty Beyond (3 Months)	14,750	0	10,000	0					
12	Competitive Trade-in Hamada 600 CD Press (Serial #HR104-82)	17,500	0	17,500	0					
13	Documents on Demand Capture Station	68,888	12,888	71,105	353,115	7,363	855		855	
14	300 DPI Laser Draft Printer (HP-4M) and Interface Kit	428,490	4,910	0			37		37	
15	Upgrade 19" graphics monitor to 21" color monitor	0	0	0	0		0		0	
16	PC Processor Upgrade to 102/66	0	0	0	0		0		0	
17	Image Print Pch (IPP) for 1.1 Print Server	0	0	0	0		0		0	
18	SCSI FX	0	0	0	0		0		0	
19	On site analyst	0	0	0	0		0		0	
20	Subtotal	68,888	4,910	0	68,888	1,468	37		37	
21	Total	498,379	17,688	71,105	426,004	8,821	882		882	
22	System Service Agreement - FSL Plan (all copies = .0086)	n/c	n/c	0	0		1,142	7,060	8,222	
23	Sys Serv Agmt - High Vol FSL (Up to 1.2 mil > = .002) Mod 5	n/c	n/c	0	0		6,460	6,460	6,460	
24	System Service Agreement - Run length (1st ten orig = .0086 + all copies = .0023)	n/c	n/c	0	0		2,065	4,163	6,908	
25	Operator Training	5 days	n/c	0	1,650					
26	DocuTech Publisher Security Administration	1 day	n/c	0	275					
27	DocuTech Publisher Site Administration	1 day	n/c	0	275					
28	DocuTech Network Publisher Site & Security Network/Media Server	1/2 day	n/c	0	275					
29	DocuTech Network Publisher Operator Network/Media Server	1 day	n/c	0	425					
30	DocuTech Network Services Network Administration	2 days	n/c	0	675					
31	DocuTech Network Services Print Job Management	2 days	n/c	0	675					
32	DocuTech Extended Storage	1 day	n/c	0	425					
33	DocuTech Signature Booklet Maker Operator	1 day	n/c	0	425					
34	DocuTech Signature Booklet Maker Cover Insertion Module	Per Session	n/c	0	225					
35	DocuTech Document Prep & Submission for Network Server	1/2 day	n/c	0	275					
36	DocuTech Customized Training & Technical Support	\$55/hour	n/c	0	0					
37	Supplies									
38	Dry Ink (\$158.00/Cartridge) Mod 5	220K/Unit	180					982		
39	Developer	750K/Unit	194					310		
40	Fuser Agent	250K/Unit	38					198		
41	Slitter/Tire	32K/Reel	47					0		
42	Binding Tape	445/Reel	93					0		
43	Subtotal		3,888		0		7,452	1,478		
44	Total		3,888		0					
45	DocuTech Productivity Measurement Standards									
46	Impressions per minute									
47	Hourly Production									
48	24 Daily Production (5 hrs daily)									
49	Weekly Production									
50	Monthly Production									
51	Recommended MRP's Std									
52	750K - 1,000K									
53										

Inc In Pmt Rate	0	Evaluation	37,689
Annual	7,452	Training	6,000
	1,478	TOP+ Maintenance+ Supplies	17,751
			213,017

Total 90 Day Evaluation Costs (Unlimited number of copies)	0
One Time Costs	6,000
Total TDP (Full System)	498,379

**All pricing numbers are subject to change, for planning purposes only.**

	Annual Costs in Constant Dollars 90 Day Evaluation
Year 1 Costs (1.2 million units per month)	
Year 2 Costs (1.2 million units per month)	
Year 3 Costs (1.2 million units per month)	
Year 4 Costs (1.2 million units per month)	
Year 5 Costs (1.2 million units per month)	

90 Day End	LTWP	Maintenance	Supplies (excludes food and fuel)	Total
\$17,689	\$105,851	\$168,944	\$17,741	\$17,689
\$0	\$0	\$0	\$0	\$200,557
\$0	\$105,851	\$168,944	\$17,741	\$200,557
\$0	\$0	\$0	\$0	\$200,557
\$0	\$105,851	\$168,944	\$17,741	\$200,557
\$0	\$0	\$0	\$0	\$200,557
\$0	\$105,851	\$168,944	\$17,741	\$200,557
\$0	\$0	\$0	\$0	\$200,557



A B C D E F G H I J K L M

Estimated Production Workload To Recover LTOP Costs Based Upon Phase 2 Evaluation Cycle												
Category	Rate	Job 1	Job 2	Job 3	Job 4	Job 5	Job 6	Job 7	5000 Printed from File CPO Impl.	Costs		
Total Impressions	15	252,000	80,000	500,000	250,000	100,000	20,000	5,000	355,404	\$27,490.00		
1-Sided Prints	15	48	40	50	25	0	1,000	0	NA	\$17.45		
2-Sided Prints	20	0	0	0	0	5,000	0	0	NA	\$100.00		
11x17 Prints	25	0	0	0	0	0	0	100	NA	\$2.50		
11x17 Impressions	15	0	0	0	0	0	0	0	NA	\$0.00		
Single Print Jobs	15	0	0	0	0	0	0	0	NA	\$0.00		
Seams	30	48	20	50	0	2	1	0	NA	\$3.63		
Binds	200	0	0	1,000	0	0	0	0	NA	\$200.00		
Single Stitches	5	0	100	0	0	0	0	0	NA	\$0.50		
Dual Stitches	10	0	0	0	2,000	0	0	0	NA	\$20.00		
Total Booklets	24	0	0	0	0	0	0	250	NA	\$5.00		
11x17 Booklets	20	300	0	0	0	0	0	0	NA	\$5.00		
Total Cost		\$3,788.16	\$1,201.70	\$7,702.25	\$3,770.38	\$1,600.06	\$315.03	\$83.50	\$3,365.00	\$27,845.08		
Cost Per Impression		\$0.01503	\$0.01502	\$0.01540	\$0.01508	\$0.01600	\$0.01575	\$0.01670	\$0.02641	\$0.01692		
Number of Jobs		35	40	10	5	10	20	20	NA	140		
Pages Per Pub		24	20	50	25	1	1	1	NA	17		
Number of Orig Pages		840	800	500	125	10	20	20	NA	2,315		
Number of Pages		300	100	1,000	2,000	5,000	1,000	250	NA	257,000		
# of SBMF Pages		252,000	0	0	0	0	0	5,000	NA	257,000		
Cost Per Publication		\$12.63	\$12.02	\$7.70	\$0.38	NA	NA	\$0.02	NA	\$1.68		

Impressions  
1,562,404

1,000  
100  
4,000

= Total Cost  
= Avg \$/Page  
= Similar Jobs  
= Avg # Pg/Job  
= # Original Pgs

= # SBMF Pgs  
= Avg \$/Job

1,562,404

Current Alg	Cost/Page	Estimated Yrly \$
FY 93 volume	5090 copies	\$0.01692
CPO Reassign	Figure 7 copies	335,404
Incl 5090	Est Yrly copies	9,225,520
# Pg 7 Vol	Recovery	9,580,924
# 1.2M/With	Capacity	162,155
Revenue		14,400,000
25% Reduction		\$0.02625
		75.00%
		\$283,500.00

After 25% Budget Reduction, ROI = 1.07

Figure 17. Phase-2 estimated production profile.

FINAL COST BENEFIT CALCULATIONS - GSFC										
Workload Profile: Stapling, single and dual; Perfect binding; Saddle stitching, 11 x 17 and 5.5 x 8.5 Hard copy; electronic media, diskette and electronic file transmittal										
Combined Annual Operating Expense As Reported In JCP Form 1										
Equipment	Maintenance	Supplies	Labor	Space	Depreciation	Cost	Date Acq	Rental	One Time Purchase	
Printing (Col A):	0	0	0	0	0	0		0	0	
Duplicating (Col C):	0	0	0	0	0	0		0	0	
JCP Total:	0	0	0	0	0	0		0	0	
GPO Total Impressions		29,353,644		Inflation =		2.50%		Shifts=		1
In-House Duplicating		5,500,483		Paper =		0.0050				
Estimated DocuTech		19,015,638								
Alternative 1 (GPO)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (GPO Contracts)	Not Applicable	593,210	608,040	623,241	638,822	654,793	3,118,107			
Network HW/SW	Not Available	0	0	0	0	0	0			
Labor (GS 11-5)	0	39,719	40,712	41,730	42,773	43,842	208,776			
Supplies	Not Applicable	0	0	0	0	0	0			
Maintenance	Not Applicable	0	0	0	0	0	0			
Depreciation	Not Applicable	0	0	0	0	0	0			
Space	Not Applicable	0	0	0	0	0	0			
Finishing	Not Applicable	0	0	0	0	0	0			
Alternative 1 Total:	0	632,929	648,752	664,971	681,595	698,635	3,326,883			
Cost Per Thousand:		\$21.56	\$22.10	\$22.65	\$23.22	\$23.80	\$22.67			
Alternative 2 (In-House Duplicating)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (On Site Dupl)	Not Applicable	209,000	209,000	209,000	209,000	209,000	1,045,000			
Network HW/SW	Not Available	0	0	0	0	0	0			
Labor (WG 8-2)	0	34,382	35,242	36,123	37,026	37,952	180,725			
Supplies (Paper Only)	0	27,502	28,190	28,895	29,617	30,358	144,562			
Maintenance	Not Applicable	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
Finishing-Single Staple Only	0	0	0	0	0	0	0			
Alternative 2 Total:	0	270,885	272,432	274,018	275,643	277,309	1,370,287			
Cost Per Thousand:		\$49.25	\$49.53	\$49.82	\$50.11	\$50.42	\$49.82			
Alternative 3 (Without Documents On Demand)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (LTOP)	0	86,538	86,538	86,538	86,538	86,538	432,690			
Network HW/SW (Ind in LTOP)	0	0	0	0	0	0	0			
Labor (GS 8-5)	0	34,382	35,242	36,123	37,026	37,952	180,725			
Supplies (Includes Paper)	0.0050	95,078	97,455	99,892	102,389	104,949	499,762			
Maintenance (Per Copy)	0	80,714	80,714	80,714	80,714	80,714	403,570			
Depreciation (10%)	LTOP	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
One Time Charge	SW/TS/TR	10,000	10,000	10,000	10,000	10,000	50,000			
Alternative 3 Total:	0	306,713	309,949	313,267	316,667	320,152	1,566,747			
Cost Per Thousand:		\$16.13	\$16.30	\$16.47	\$16.65	\$16.84	\$16.48			
Alternative 4 (Networked DocuTech/Documents On Demand System)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (LTOP)	0	104,152	104,152	104,152	104,152	104,152	520,759			
Network HW/SW (Ind in LTOP)	0	0	0	6,579	6,579	6,579	19,737			
Labor (WG 8-2)	0	68,765	70,484	72,246	74,052	75,903	361,450			
Supplies (Includes Paper)	0.0050	95,078	97,455	99,892	102,389	104,949	499,762			
Maintenance (>1.2M = .002)	0	80,714	80,714	80,714	80,714	80,714	403,570			
Depreciation (10%)	LTOP	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
One Time Charge	SW/TS/TR	10,000	0	0	0	0	10,000			
Alternative 4 Total:	0	358,709	352,805	363,582	367,886	372,297	1,815,279			
Cost Per Thousand:		\$18.86	\$18.55	\$19.12	\$19.35	\$19.58	\$19.09			
Alternative Cash Flow Comparisons										
Alternative 1 (GPO)	0	632,929	648,752	664,971	681,595	698,635	3,326,883			
Alternative 2 (In-House)	0	270,885	272,432	274,018	275,643	277,309	1,370,287			
Alternative 1 + 2	0	903,814	921,184	938,989	957,238	975,944	4,697,170			
Alternative 3	(0)	306,713	309,949	313,267	316,667	320,152	1,566,747			
Alternative 4	(0)	358,709	352,805	363,582	367,886	372,297	1,815,279			
Savings ((Alt 1 + 2) - Alt 4)	0	545,105	568,379	575,406	589,353	603,648	2,881,891			
Return On Investment #4	0	1.70	1.73	1.68	1.66	1.64				
Assumes Productivity Increase of 5%/Yr										
Alternatives	Initial Cash Outlay	Interest Rate	NPV	PV	Benefits	B/C Ratio	Avg Cost/Yr	Avg Cost/Thousand		
Alternative 1	0	6.50%	2,756,514	2,765,092	0	Not Applicable	665,377	\$22.67		
Alternative 2	0	6.50%	1,138,056	1,138,895	1,956,596	1.43	274,057	\$49.82		
Alternative 1 + 2	0	6.50%	3,894,570	3,903,986	(1,370,287)	-0.29	939,434	NA		
Alternative 3	(0)	6.50%	1,300,425	1,302,180	1,760,135	1.12	313,349	\$16.48		
Alternative 4	(0)	6.50%	1,506,559	1,508,743	1,511,604	0.83	363,056	\$19.09		
Annual Productivity Savings Based On .5% to 6% Per Year										
Pay Period 3	Productivity - .5%	Productivity - 1%	Productivity - 2%	Productivity - 3%	Productivity - 4%	Productivity - 5%	Productivity - 6%			
Total Hours/Pay Period	137,053	685	1,371	2,741	4,112	5,482	6,853	8,223		
FTE/Pay Period	1,713	9	17	34	51	69	86	103		
Avg S/FTE (Ind Benefits)	\$71,153									
Average Savings/Yr	Not Applicable	\$609,483	\$1,219,967	\$2,437,933	\$3,656,900	\$4,875,866	\$6,094,833	\$7,313,799		

Figure 18. Cost benefit and productivity calculations.

## Productivity Analysis

Application Category	Original Elapse Time @ Printer + Mailing	Original Processing Time	Proposed Elapsed Time @ DocuTech + Mailing	Proposed Processing Time
1. Director's Weekly	3 - 5 days	18:26 hours	< 1 day	5:24 hours
2. Goddard Weekly	3 - 5 days	18:26 hours	< 1 day	5:18 hours
3. GEWA Newsletter	1 day	15:05 hours	< 1 day	5:57 hours
4. Goddard News	5 + days	15:45 hours	< 1 day	13:13 hours
5. NSSDC News	5 + days	15:45 hours	< 1 day	4:43 hours
6. NASA TM	5 + days	13:45 hours	< 1 day	2:35 hours
7. GSFC 17-92 Training Form	5 days	9:45 hours	< 1 day	7:55 hours
8. 1994 GSFC Honor Awards	5 days	10:10 hours	< 1 day	3:28 hours
Total	Range 1 - 5 + Days	117:12 hours	< 1 day	48:55 hours

**Figure 19. Productivity comparisons.**

Figure 19 shows that a percentage gain of approximately 80% is obtained when a customer's duplicating job is submitted to the networked DocuTech. Previously, a duplicating job would take 5 plus days and now takes less than 1 day to deliver the end product to the customer. Specifically, the processing time is reduced from 117 hours, 12 minutes to 48 hours, 55 minutes or approximately 58% reduction in processing time.

### Phase 1 - Return on Investment

During the phase-1 evaluation and analysis of the benefits and costs, it has been conclusively identified that full cost recovery can be achieved without any additional funds required, reference Figure 15. Specifically, the cost for the phase-2 evaluation is \$17,899, and the revenue to cover this cost is estimated to be \$24,245 for the application categories identified. During the phase-2 evaluation period (90 days), there will be no restrictions on the number of impressions produced. As described earlier, actual production statistics will be gathered by customer account code to validate the estimated revenues to cover the operational costs of the networked DocuTech/Documents on Demand system. For the phase-2 evaluation, the Return on Investment (ROI) identified during the phase-1 evaluation is  $ROI = \text{Gained} \text{ divided by } \text{Cost} = \$24,245 / \$17,899 = 1.35$ .

Or more specifically, for every dollar invested, \$1.35 is returned. Physical storage and mailing costs will not be considered in this analysis as cost savings are over and above the savings identified by the acquisition of the networked DocuTech/XDOD systems.

## **Phase 2 - 90-DAY EVALUATION**

### **Benchmark Requirements**

On designated day of the benchmark demonstration test, 7 hours of production duplicating work shall consist of the following minimum work requirements:

- Test 1            Daily workload from Xerox 5090 and at least 2 hours of previous daily workload in queue ready to be released for output by 8:30 a.m., the day of the test. [Test capacity to perform workload.]
- Test 2            Assembly of publication by Publication and Graphics Services Section to be sent to DocuTech for duplicating after demonstrating cut and paste, merging of pages, renumbering of selected pages, and cover changes from XDOD. [Test functionality of XDOD and receipt and transfer of designated publications to DocuTech.]
- Test 3            Demonstration of mail merge through Set Labeling for selected publication with multiple addresses. [Test functionality of addressing.]
- Test 4            Receipt of latest version of Evaluation Report (assembly of 4 Postscript files) and Joint Electronic Document Distribution Plan from Code JTT PC workstation to XDOD client/server. [Test functionality of receipt and transfer of files from remote PC workstation to XDOD.]
- Test 5            Receipt of latest version of Evaluation Report (assembly of 4 Postscript files) and Joint Electronic Document Distribution Plan from the XDOD server. The Evaluation Report will be finished as a tape-bound publication and the Joint Electronic Document Distribution Plan will be finished as a saddle stitch publication. [Test functionality of finishing capabilities and cover insertion module.]
- Test 6            Scan, cut and paste, assembly of selected pages on XDOD, Earth Observing System publication. Transfer of designated pages to DocuTech for assembly with stored electronic files to be assembled as a final publication. [Test functionality of receipt and transfer of files from remote Macintosh workstation plus functionality of XDOD.]
- Test 7            Compare quality of output:
  - a.        Source versus first copy, 25th copy, and 50th copy
  - b.        Graphics
  - c.        Half tones
  - d.        Finishing (saddle stitch, single stitch, double stitch, taping)
  - e.        Finishing (saddle stitch - 8.5 inch x 11 inch and 5.5 inch x 8.5 inch)[Test output quality.]
- Test 8            Concurrency of operations:
  - a.        Duplicating during scanning of new job
  - b.        Receipt of electronic files to be duplicated during duplicating and scanning of new jobs
  - c.        Cut and paste during duplicating

- Test 9            Test storage of ripped files from Print Server to Extended Storage and retrieval for duplicating by DocuTech. [Test functionality of Extended Storage.]
- Test 10          Print accounting statistics at end of benchmark. [Test functionality of DocuTech accounting program.]

### Pre-Benchmark File Transfer Testing

Table 1, below, documents the pre-benchmark testing for the transfer and printing of publications to the XDOD and DocuTech located at GSFC. Verification of successful transmission and receipt of the publication is confirmed by comparing the print product from an Apple LaserWriter located within Code JTT's LAN-connected printers and the printed output from the DocuTech. A second single thread test is the successful receipt of a file transfer from the Code JTT PC work station to the XDOD client server and the subsequent transfer of the same publication from the XDOD to the DocuTech Print Server for subsequent printing by the DocuTech.

**Table 1. Pre-benchmark transfer results**

Date & Time	File Name	# Bytes	Source Program	PS Print File	PS Bytes	Pages	Transfer Rate Kb/s	Output Verified LW	Output DocuTech XDOD
10/24/94 10:13 am	JTEDIPLN.WPD	2,977,473	WP 6.0a	EDIPLN.PS	4,552,503	37	33	Yes	NA
10/25/94 2:45 pm	EVALRPT.WPD	2,970,512	WP 6.0a	EVALRPT1.PS	1,140,695	18	71	Yes	DocuT-N XDOD-N
				EVALRPT2.PS	4,018,030	7	71	Yes	DocuT-N XDOD-N
				EVALRPT3.PS	773,126	13	71	No	DocuT-N XDOD-N
10/26/94 8:38 am	EVALRPT.WPD	2,983,449	WP 6.0a	EVALRPT1.PS	1,143,378	18	64	Yes	DocuT-Y XDOD-Y
				EVALRPT2.PS	4,023,092	7	64	Yes	DocuT-Y XDOD-N
				EVALRPT3.PS	5,411,768	13	64	Yes	DocuT-Y XDOD-N
10/28/94*	EVALRPT.WPD	2983,449	WP 6.0a	EVALRPT1.PS	1,143,378	18	NA	Yes	XDOD-N
				EVALRPT2.PS	4,023,092	7	NA	Yes	XDOD-N
				EVALRPT3.PS	5,411,768	13	NA	Yes	XDOD-N
10/28/94 7:22 am	JTEDIPLN.WPD	1,249,954	WP 6.0a	EDIPLN.PS	3,038,533	38	74	Yes	DocuT-Y XDOD-N
10/28/94 8:45 pm	JTEDIPLN.WPD	1,249,954	WP 6.0a	EDIPLN.PS	3,038,533	38	26	Yes	XDOD-N
11/3/94 11:30 pm	JTEDIPLN.WPD	1,278,481	WP 6.0a	EDIPLN.PS	3,375,855	38	52	Yes*	DocuT-Y**
	RDPEI.WPD	98,377	WP 6.0a	EDIPLNRP.PS	1,548,159	1	52	Yes*	DocuT-Y**
11/4/94 6:30 am	EVALRPT.WPD	3,014,439	WP 6.0a	EVALRPT1.PS	2,711,023	25	59	Yes*	DocuT-Y**
				EVALRPT2.PS	3,563,580	3	52	Yes*	DocuT-Y**

Date & Time	File Name	# Bytes	Source Program	PS Print File	PS Bytes	Pages	Transfer Rate Kb/s	Output Verified LW	Output DocuTech XDOD
				EVALPRT3.PS	3,218,756	13	72	Yes*	DocuT-Y**
				EVALRPT.PS	1,220,466	1	69	Yes*	DocuT-Y**
11/7/94 10:50 am	JTEDIPLN.PS	1,278,481	WP 6.0a	EDIPLNA.PS	3,375,855	38	15	Yes*	XDOD-R***
	RDPEI.WPD	98,377	WP 6.0a	EDIPLNRP.PS	1,548,159	1	16	Yes*	XDOD-R***
11/15/94 6:15 am	EVALRPT.WPD	3,014,439	WP 6.0a	EVALRP1a.PS	2,711,071	25	16	Yes*	XDOD-Y***
				EVALRP2b.ps	3,563,580	3	16	Yes*	XDOD-Y***
				EVALRP3a.PS	3,220,400	13	16	Yes*	XDOD-Y***
				EVALRP4.aPS	1,220,519	1	16	Yes*	XDOD-Y***

Note: \*Font - TimesNewRomanPS Regular 11 pt [w/pscript.drv on AppleLaser II NTX]  
\*\*Font - Times New Roman Regular 11 pt [h/windows/hppcl5c.drv on HP Laserjet 4M/M]  
N\*\*\* File Not received by XDOD Y\*\*\* File successfully received by XDOD

**Table 1. (Continued).**

Attempts at Connecting to XDOD

Date	Time	Remarks
10/28/94	7:22 am	On continuous ping
	8:10 am	Successful ping
	8:45 am	Start transfer
	8:48 am	Transfer stopped at 794,624 bytes or 26% complete
	10:58 am	Abort transfer, unsuccessful
10/31/94	10:03 am	Unsuccessful ping
11/3/94	7:55 am	Unsuccessful ping
	11:30 am	Unsuccessful ping
11/4/94	6:36 am	Unsuccessful ping
	7:22 am	Unsuccessful ping
	7:43 am	Unsuccessful ping
11/7/94	6:02 am	Unsuccessful ping
	10:40 am	Start transfer, successfully completed (2 files)
	10:50 am	Start transfer
	10:55 am	Transfer stopped at 1,404,928 bytes or 51% complete
	11:30 am	Abort transfer, unsuccessful
11/16/94	6:23 am	Successful transfer of all 4-files to XDOD and DocuTech

### Access to XDOD From Code JTT Work Station Using PC and Windows

1. Select FTP application icon.
2. Select Settings Option and highlight Preferences  
. Turn off "Retrieve detailed file listing"
3. Select Connect  
Host: xdod.gsfc.nasa.gov  
User: xxxxxxxx  
Password: yyyyyyyy
4. Remote XDOD directory should be "C:\PUBDROP\XSFER"

### Access to DocuTech From Code JTT Work Station Using PC and Windows

1. Select FTP application icon.
2. Select Settings Option and highlight Preferences  
. Turn on "Retrieve detailed file listing"
3. Select Connect  
Host: docutech.gsfc.nasa.gov  
User: zzzzzzzz  
Password: kkkkkkk
4. Select Remote Subdirectory  
Remote XDOD directory should be "/sys/users/sunusers/switty"
5. Select Binary
6. Locate file under Local Directory to be transfered
7. Select Copy to Remote Directory
8. Successful receipt of file will show file under "switty" Subdirectory.

**Table 2. Pre-Benchmark Comparisons**

Pre-Benchmark Comparisons							
Item	Transfer To DocuTech (Minutes)	Print Output Apple LaserWriter (Minutes)	Duplicate 50 copies (Minutes)	Single Staple - 50 copies (Minutes)	Print Output/Finishing DocuTech (Minutes)	Total Time (Minutes)	Quality
39 page publication	1.58	9.75	39	25	14.44		
Present Procedure		9.75	39	25		73.75	
Electronic File To DocuTech	1.58				14.44	16.02	
Productivity Improvement						57.73	Copy of original
Percent Improvement						78.27%	All originals

Note: Transit time between pickup from Apple LaserWriter to copier and stapling not identified

## Benchmark Results

**Table 3. Benchmark Results.**

Test	Functionality	Score	Test Results
1	Inclusion of daily production workload	2	As displayed by Figure 18, Test 1, 7 regular production jobs were completed concurrently with the benchmark tests.
2a	XDOD functionality	2	The XDOD operator took eight minutes to scan text pages, paste in halftone, scan full page photo, and merge cover into file to created intended document. After several adjustments, the final image produced of the halftone was an improvement in quality from the original.
2b	File transfer to DocuTech from XDOD	2	As displayed by Figure 18, Test 2b, files transferred to the DocuTech were successfully received and ripped in preparation for the print queue.
3	Set labeling	2	A two sided announcement page was individually affixed with 450 different address labels out of 500 copies printed. Reference Figure 18, Test 3.
4	File transfer from Hqts PC to XDOD & DocuTech	2	As displayed by Figure 18, Test 4 and Appendix 4, four files were successfully transferred to the XDOD and DocuTech.
5	Print copy of electronic files	2	As displayed by Figure 18, Test 5, the electronic version of the XDOD electronic file received earlier from the Headquarter's PC work station was successfully printed with three types of finishing, single staple, dual staple, and tape.
6a	Tabs	2	A previously stored EOS publication file was retrieved from extended storage, five tabs with appropriate headings were merged with ten copies of the publication being printed. Reference Figure 18, Test 6.
6b	Transfer of EOS pub from Macintosh work station	2	The EOS publication (17 Mb) was sent to the XDOD by the Publication staff's Macintosh to the XOD with 10 seconds to prepare and 13 minutes to transfer.
7	Output quality	2	As displayed by Figure 18, Test 7, output quality met all the performance specifications where applicable. Dual stapling on the booklet maker for the 5.5 inch x 8.5 inch pub was slightly off center which can be corrected by the Xerox maintenance staff.
8	Concurrency	2	As displayed by Figure 18, Test 8, the job functions as itemized were accomplished concurrently with the printing of Test 1, 4, 5, 6, and 9.
9	Extended Storage	2	As displayed by Figure 18, Test 9, extended storage was successfully demonstrated.
10	Accounting	2	A printout of all work produced during the day was provided at 4:45 p.m., November 16, 1994.
	Composite	24	Fully successful



In summary, the Xerox networked DocuTech and the Xerox Document on Demand system fully met the functional requirements expected. Lessons learned during the phase-2 evaluation and the benchmark are

#### XDOD

1. Transfer of file size to the XDOD by Macintosh can be confirmed with further validation by XDOD operator to ensure that file integrity was not contaminated during the transfer.
2. With additional experience with the XDOD system, compensations can successfully be made for some degree of over- or under-exposure or capturing an image from color paper.
3. With the ability for the XDOD to view, delete, and replace stored files on the DocuTech Print Server, the XDOD operator will need to pay specific attention to the network drives that he/she maybe transferring files to.

#### DocuTech

1. With the availability of concurrency offered by the networked DocuTech, attention needs to be paid to the scheduling of the workload to provide a maximum throughput with the least amount of effort. The optimal mix will be achieved as the DocuTech operator becomes familiar with the networked jobs along with the hard copy jobs to be scanned. That is, the mix of production jobs that require single stitching, dual stitching, taping, set labeling, slip sheets, cut and paste, and tabs need to be group together to achieve maximum production. I.e., minimizing the amount of setup by the DocuTech Operator will increase the production and reduce the overall costs of the Printing and Duplicating Services Section.
2. Scheduling of production jobs for the booklet maker need to be group to avoid the necessity to reset the booklet maker for saddle stitch jobs requiring 5.5 inch x 8.5 inch finishing versus those jobs requiring 8.5 inch x 11 inch finishing. The adjustment to the booklet maker takes approximately 20 to 30 minutes each time a change in the size of the finishing is required.
3. Whenever possible, the submission of completed electronic files that have completed the clearance procedure by the Publications and Graphics Services Section is the desired mode of operation. Use of the XDOD for cut and paste, assembly and duplicating requirements (electronic job ticketing) is recommended mode of operation.

#### Other

1. Involve the network organization during the initial implementation to ensure that communication connections between the networked DocuTech, XDOD, and the user community are operational for Macintosh, Personal Computer, and SUN workstations. Check packet transmission sizes, if XDOD locks up during a file transfer.
2. To achieve an estimated annual production of 19,015,638 impressions, based upon the benchmark effective production volume, a two shift operation will need to be instituted. Figure 21, Final cost/benefit analyses, alternative 4 covers these costs through the use of two duplicating operators and coverage for maintenance and supplies

Benchmark Test 4	Start File Transfer @ 6:15 am (Hqts PC)				XDOD	File Transfer Comparisons			
	Report	Bytes	Kbps	File Transfer Time (Minutes)	Time (Minutes)				
	EVALRP1b.PS	2,682,122	17		0.92				
	EVALRP2b.PS	3,605,914	18		1.38				
	EVALRP3b.PS	3,234,960	17		1.33				
	EVALRP4b.PS	1,220,522	17		0.53				
	Total (XDOD)	10,743,518	69	2.60	4.17				
	EVALRP1c.PS	2,682,122	73						
	EVALRP2c.PS	3,605,914	75						
	EVALRP3c.PS	3,234,960	73						
	EVALRP4c.PS	1,220,522	66						
	Total (DocuTech)	10,743,518	287	0.62					
						Hqt PC work station to XDOD = 2.60 minutes			
						XDOD to DocuTech Print Server = 4.17 minutes			
						Hqt PC work station to DocuTech Print Server = .62 minutes			

Test 1	Regular Production Work				
	IMD Job #	Originals	Actual Count	Machine Count	Print Time (Minutes)
	238	10	300	301	2.23
	241	2	4,200	4,202	31.13
	251	9	150	152	1.13
	250	20	480	482	3.57
	244	2	7,500	7,501	55.56
	262	52	3,120	3,221	23.86
	EGRET	34	12,988	12,989	96.21
			Total (Minutes)		213.69
			Total (Hours)		3.56

Test 2b	XDOD Transfer				Time	Quality			
	Job	Originals	Tape, SStaple	Count	Setup	Copy 1	Copy 25	Copy 50	Last Copy
	Eval Report	44	Double Staple,	24	2 Min	Good	NA	NA	Good
	EDD Plan	36	Saddle Stitch,	25	2 Min	Good	NA	NA	Good
	EOS Pub	87	Insert 1	10	2 Min	Good	NA	NA	Good
			Tab 5						

Test 3	Demo Set Labeling				Time	Quality			
	Job	Originals	Labels	Count	Setup	Copy 1	Copy 25	Copy 50	Last Copy
	Announcement	2	450	500	5 Min	Good	Good	Good	Good

Test 6 & 9	Demo Tabs, Extended Storage, & XDOD				Time	Quality			
	Job	Originals	Tab 5	Count	Setup	Copy 1	Copy 25	Copy 50	Last Copy
	EOS Pub - Extended	87	5	10	13 Min	Good	Good	Good	Good
	EOS Pub - XDOD	87	5	10	13 Min	Good	Good	Good	Good

Test 4 & 5	EDD & Eval Plan				Time	Quality			
	Job	Originals	Insert	Count	Rip	Copy 1	Copy 25	Copy 50	Last Copy
	Joint STI EDD Plan	37	1		10 Min	Good	NA	NA	Good
	Evaluation Report	44			6 Min	Good	NA	NA	Good

Test 8	Concurrency				Time
	Job	Originals			Setup
	Set Labeling	450 addresses			5 Min
	Cover Insertion	1 Cover			11 Min
	Tab 5	5 Tabs			13 Min
	Print Server	7 Source files			6 Min
	Extended Storage	1 Source File			2 Min

Test 7	Total Production Workload				Print	Output Quality				
	Job	Originals	Copies	Count	Quality	Stapling	Tape	Tab 5	Insert	Saddle
	EOS Pub	92	10	920	Good	NA	NA	Good	NA	NA
	EDD Plan	37	25	925	Good	NA	NA	NA	Good	Good-11x17
	Eval Plan	44	24	1,056	Good	Good-1&2	Good	NA	NA	NA
	Announcement [241]	2	500	1,000	Good	NA	NA	NA	NA	NA
	Handbook Distrib [251]	9	150	1,350	Good	Good-1	NA	NA	NA	NA
	Space Parts News [250]	20	480	9,600	Good	Good-1	NA	NA	NA	NA
	DD Form 1419 [244]	2	75	150	Good	NA	NA	NA	Good	NA
	Egret Pub	34	382	12,988	Good	Good-2	NA	NA	NA	NA
	Fab User's Guide	8	25	200	Good	Offset-2	NA	NA	NA	Fair-8.5x5.5)*
	TISB Fall Retreat [262]	52	60	3,120	Good	NA	NA	Good-4	NA	NA
	Miscellaneous			6,875	Good	NA	NA	NA	NA	NA
	Total:			38,184						
	@ 135 copies/minute =				4.71	hours				
	Effective copies/minute =				79.55	copies/minute (Includes stapling, setup, taping, booklet maker, scanning)				

Note:\* Requires adjustment to staple alignment.

System locked up at 2:10 p.m., rebooted and running at 2:14 p.m.

Accounting statistics printed out at 4:45 p.m.

Figure 20. Benchmark results.

## Validation of Cost Analysis

The phase-1 cost analysis is validated through the collecting of production statistics generated by the networked DocuTech and is displayed by Tables 4 and 5. Production statistics were gathered weekly by user account codes which have been programmed into the networked DocuTech. Supporting information for each user account code can be found in appendix 4.

**Table 4. Production Statistics**

Acct (1994)	Wk 1 (7/1 - 8/19)	Wk 2 (7/21 - 8/26)	Wk 3 (8/28 - 9/03)	Wk 4 (9/04 - 9/10)	Wk 5 (9/11 - 9/17)	Wk 6 (9/18 - 9/24)	Wk 7 (9/25 - 10/01)	Wk 8 (10/02 - 10/08)	Wk 9 (10/09 - 10/15)
100		33,427	71,905	80,840	21,294	8,992		7,392	33,720
200		26,285	34,451	46,640	75,841	106,528	82,312	66,878	54,072
300			3,720			6,994	1,950		8,818
400			14,516	39,713					4,572
500		9,517				18,802	2,406		
600		30,771	7,668	5,758	4,812	18,604	2,613	17,725	6,222
700		37,403		4,004	5,976	1,001	462	2,002	2,204
800									
900				3,133	23,436		12,341	40,289	56
99999	312,799		27	889	42	85	778	1,181	645
<b>Total Impres</b>	312,799	137,403	132,287	180,977	131,401	161,006	102,802	135,467	110,309
<b>Cum Impres</b>	312,799	450,202	582,489	763,466	894,867	1,055,873	1,158,675	1,294,142	1,404,451
<b>Revenue</b>	\$1734.63	\$3,396.30	\$2,394.28	\$2,940.83	\$2,740.18	\$3,756.71	\$2,152.46	\$3,128.36	\$2,357.11
<b>Cum Revenue</b>	\$1,735	\$5,131	\$7,525	\$10,466	\$13,206	\$16,963	\$19,115	\$22,244	\$24,601
<b>Cost/Pg</b>	\$0.0055 5	\$0.02472	\$0.01810	\$0.01625	\$0.02085	\$0.02333	\$0.02094	\$0.02309	\$0.02137

Table 5 identifies the results of the Benchmark shows that using the current assigned cost algorithm, a revenue of \$600.34 was received for the day. To breakeven, the total number of impressions for the day need to be 87,764 to cover the annual operational DocuTech costs of \$358,709, per Figure 21.

**Table 5. Production Statistics**

<b>Acct (1994)</b>	<b>Wk 10 (10/16-10/22)</b>	<b>Wk 11 (10/23- 10/29)</b>	<b>Wk 12 (10/30-11/05)</b>	<b>Wk 13 (11/6-11/12)</b>	<b>Wk 14 (11/13-11/19)</b>	<b>Wk 15 (11/20-11/26)</b>	<b>Wk 16 (11/27-12/03)</b>	<b>Wk 17 (12/04-12/10)</b>	<b>BchMk (11/16)</b>
<b>100</b>	9,410	16,194	3,199	6,812	8,406	16,426			8,406
<b>200</b>	27,763	10,199	33,355	20,913	3,550	29,830			3,550
<b>300</b>	9,328		14,715		10,548				10,548
<b>400</b>			10,683						
<b>500</b>						6,324			
<b>600</b>		11,333	12,116		11,939				11,939
<b>700</b>	21,038		111			2,205			
<b>Bchmk</b>					3,741				3,741
<b>900</b>	23,890		5,537	9,911		11,377			
<b>99999</b>	389	409	5,762	3,023		2,503			
<b>Total Impres</b>	91,818	38,895	85,478	40,659	38,184	68,665			38,184
<b>Cum Impres</b>	1,496,269	1,535,164	1,620,642	1,661,301	1,699,485	1,768,150			NA
<b>Revenue</b>	\$2,006.64	\$852.26	\$1,438.90	\$831.66	\$600.34	\$1,998.47			\$600.34
<b>Cum Revenue</b>	\$26,608	\$27,460	\$28,899	\$29,730	\$30,331	\$32,329			NA
<b>Cost/Pg</b>	\$0.02185	\$0.02191	\$0.01683	\$0.02045	\$0.01572	\$0.02910			\$0.01572

Designated cost algorithm for the Networked DocuTech are

<u>Category</u>	<u>Rate</u>
Total impressions	9
1-sided prints	15
2-sided prints	20
11-inch x 17-inch prints	25
11-inch x 17-inch impressions	15
Single print jobs	15
Scans	30

Binds	200
Single stitches	5
Dual stitches	10
Total booklets	24
11-inch x 17-inch booklets	2

### Final Comparative Cost Summaries

**Table 6. GPO/In-house Costs**

GPO Programs					
	Total Jobs	Total Impressions	Total Obligated	% Produced On DocuTech	DocuTech Estimated Total Cost
60-M	75	2,355,491	\$68,000	95%	\$64,600
680-S	43	1,948,305	\$20,210	100%	\$20,210
722's	505	24,773,568	\$480,000	43%	\$184,900
872	33	275,280	\$25,000	25%	\$6,250
Totals	656	29,353,644	\$593,210		\$275,960
Inhouse Production					
Total	948	5,500,483	\$209,000	75%	\$158,750
Grand Total of GPO Contract & Inhouse Production					\$432,710

### Yearly Cost for DocuTech (Excludes Labor Costs)

LTOP	\$108,000
Maintenance/Click Charges	\$ 81,000
Supplies	\$ 60,000
	-----
Total	\$249,000

### Cost Per Copy

Without DocuTech:	$(\$593,210 + \$209,000)/29,353,644$ copies =	\$0.02737 per copy
DocuTech:	$\$249,000/19,015,638$ copies =	\$0.01309 per copy

### Annual Savings

Savings = Grand Total of GPO Contract & Inhouse Production - Yearly Cost of DocuTech  
 = \$432,710 - \$249,000 = \$183,310  
 = Percent Reduction of 42.36%

FINAL COST BENEFIT CALCULATIONS - GSFC										
Workload Profile: Stapling, single and dual; Perfect binding; Saddle stitching, 11 x 17 and 5.5 x 8.5 Hard copy; electronic media, diskette and electronic file transmittal										
Combined Annual Operating Expense As Reported In JCP Form 1										
Equipment	Maintenance	Supplies	Labor	Space	Depreciation	Cost	Date Acq	Rental	One Time Purchase	
Printing (Col A):	0	0	0	0	0	0		0	0	
Duplicating (Col C):	0	0	0	0	0	0		0	0	
JCP Total:	0	0	0	0	0	0		0	0	
GPO Total Impressions (Reference Table 6)			29,353,644	Inflation =	2.50%	Shifts =	1			
In-House Duplicating (Reference Table 6)			5,500,483	Paper =	0.0050	Supplies	0.0012	Ink, Toner, Fuser		
Estimated DocuTech (Reference Table 6 & Cost/Copy)			19,015,638	Overage	4,615,638					
Alternative 1 (GPO)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (GPO Contracts)	Not Applicable	593,210	608,040	623,241	638,822	654,793	3,118,107			
Network HW/SW	Not Available	0	0	0	0	0	0			
Labor (GS 11-5)	0	39,719	40,712	41,730	42,773	43,842	208,776			
Supplies	Not Applicable	0	0	0	0	0	0			
Maintenance	Not Applicable	0	0	0	0	0	0			
Depreciation	Not Applicable	0	0	0	0	0	0			
Space	Not Applicable	0	0	0	0	0	0			
Finishing	Not Applicable	0	0	0	0	0	0			
Alternative 1 Total:	0	632,929	648,752	664,971	681,595	698,635	3,326,883			
Cost Per Thousand:		\$21.56	\$22.10	\$22.65	\$23.22	\$23.80	22.67			
Alternative 2 (In-House Duplicating)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (On Site Dupl)	Not Applicable	209,000	209,000	209,000	209,000	209,000	1,045,000			
Network HW/SW	Not Available	0	0	0	0	0	0			
Labor (WG 9-2)	0	34,382	35,242	36,123	37,026	37,952	180,725			
Supplies (Paper Only)	0	27,502	28,190	28,895	29,617	30,358	144,562			
Maintenance	Not Applicable	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
Finishing-Single Staple Only	0	0	0	0	0	0	0			
Alternative 2 Total:	0	270,885	272,432	274,018	275,643	277,309	1,370,287			
Cost Per Thousand:		\$49.25	\$49.53	\$49.82	\$50.11	\$50.42	49.82			
Alternative 3 (Without Documents On Demand)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (LTOP)	11,733	86,538	86,538	86,538	86,538	86,538	444,423			
Network HW/SW (incl in LTOP)	0	0	0	0	0	0	0			
Labor (GS 9-5)	0	34,382	35,242	36,123	37,026	37,952	180,725			
Supplies (includes Paper)	0.0062	117,897	120,844	123,865	126,962	130,136	619,705			
Maintenance (Per Copy)		108,185	108,185	108,185	108,185	108,185	540,926			
Depreciation (10%)	LTOP	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
One Time Charges	SW/TS/TR*	10,000	0	0	0	0	10,000			
Alternative 3 Total:	11,733	357,003	350,810	354,712	358,711	362,811	1,795,779			
Cost Per Thousand:		\$18.77	\$18.45	\$18.65	\$18.86	\$19.08	18.76			
Alternative 4 (Networked DocuTech/Documents On Demand System)										
Service Life	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Service Life \$			
Investment (LTOP)	11,733	104,152	104,152	104,152	104,152	104,152	532,491			
Network HW/SW (incl in LTOP)	0	0	0	6,579	6,579	6,579	19,737			
Labor (WG 9-2)	0	68,765	70,484	72,246	74,052	75,903	361,450			
Supplies (includes Paper)	0.0062	117,897	120,844	123,865	126,962	130,136	619,705			
Maintenance (>1.2M = .002)		108,185	108,185	108,185	108,185	108,185	540,926			
Depreciation (10%)	LTOP	0	0	0	0	0	0			
Space	0	0	0	0	0	0	0			
One Time Charges	SW/TS/TR	10,000	0	0	0	0	10,000			
Alternative 4 Total:	11,733	408,999	403,665	415,028	419,930	424,956	2,084,310			
Cost Per Thousand:		\$21.51	\$21.23	\$21.83	\$22.08	\$22.35	21.80			
Alternative Cash Flow Comparisons										
Alternative 1 (GPO)		632,929	648,752	664,971	681,595	698,635	3,326,883			
Alternative 2 (In-House)		270,885	272,432	274,018	275,643	277,309	1,370,287			
Alternative 1 + 2		903,814	921,184	938,989	957,238	975,944	4,697,170			
Alternative 3 (DocuTech)		357,003	350,810	354,712	358,711	362,811	1,795,779			
Alternative 4 (DocuTech&XDOD)		408,999	403,665	415,028	419,930	424,956	2,084,310			
Savings ((Alt 1 + 2) - Alt 4)		494,815	517,519	523,961	537,308	550,989	2,612,859			
Return On Investment #4	Savings/Alt 4	1.21	1.28	1.26	1.28	1.30				
(Alt 1 + 2) + Avg FTE Svgs	Net ROI =	2.70								
Alternatives										
Alternatives	Initial Cash Outflow	Interest Rate	NPV	PIV	Benefits	B/C Ratio	Avg Cost/Yr	Avg Cost/Thousand		
Alternative 1 (GPO)	0	6.50%	2,756,514	2,765,092	0	Not Applicable	665,377	\$22.67		
Alternative 2 (In-House)	0	6.50%	1,138,056	1,138,895	1,956,596	1.43	274,057	\$49.82		
Alternative 1 + 2	0	6.50%	3,894,570	3,903,986	NA	NA	939,434	NA		
Alternative 3 (DocuTech)	11,733	6.50%	1,481,800	1,492,537	1,531,103	0.85	359,156	\$18.76		
Alternative 4 (DocuTech&XDOD)	11,733	6.50%	1,720,101	1,732,345	1,242,572	0.60	416,862	\$21.80		
Annual Productivity Savings Based On .5% to .6% Per Year										
	Pay Period 3	Productivity - .5%	Productivity - .1%	Productivity - .2%	Productivity - .3%	Productivity - .4%	Productivity - .5%	Productivity - .6%		
Total Hours/Pay Period	137,053	685	1,371	2,741	4,112	5,482	6,853	8,223		
FTE/Pay Period	1,713	9	17	34	51	69	86	103		
Avg \$/FTE (incl Benefits)	\$71,153									
Average FTE Savings/Yr	Not Applicable	\$609,483	\$1,218,967	\$2,437,933	\$3,656,900	\$4,875,866	\$6,094,833	\$7,313,799		
* SW/TS/TR = Software/Technical Support/Training										

Figure 21. Final cost/benefit analyses.

## ACRONYMS AND ABBREVIATIONS

ARC	Ames Research Center
B/C	Benefit/Cost Ratio
CD ROM	Compact Disk Read Only Memory
Code JTT	Scientific and Technical Information Office
DPI	Dots per inch
DOS	Disk Operating System
EDD	Electronic Document Distribution
EPS	Electronic Publishing System
FTE	Full Time Equivalent
FTP	File Transfer Protocol
GB	Gigabytes
GSFC	Goddard Space Flight Center
GPO	Government Printing Office
HTM	High Technical Memorandum
IPMO	Institutional Printing Management Officer
JCP	Joint Committee on Printing
JPL	Jet Propulsion Laboratory
JOFOC	Justification for Other Than Full and Open Competition
JSC	Lyndon B. Johnson Space Center
JTX	Job Tracking System
KB	Kilobytes
Kbps	Kilo bits per second
KSC	John F. Kennedy Space Center
LAN	Local Area Network
LaRC	Langley Research Center
LeRC	Lewis Research Center
LTM	Low Technical Memorandum
LTOP	Lease to Ownership Plan
MB	Megabytes
Mbps	Mega bits per second
MOU	Memorandum of Understanding
NP	Network Publisher
NPMO	NASA Printing Management Officer
NPV	Net Present Value
MSFC	George C. Marshall Space Flight Center
MS	Microsoft
OS	Operating System
PC	Personal Computer
PDL	Print Control Language
POMD	Plant Operations Management Division
PS	Printing Specialist
PV	Present Value
RAM	Random access memory
ROI	Return on Investment
RP	Research Publication
SBUS	SCSI Bus
SCSI	Small Computer System Interface

SDT	Service Desk Technician
SQL	Structured Query Language
SP	Special Publication
STIO	Scientific and Technical Information Office
TBD	To Be Determined
TM	Technical Memorandum
WAN	Wide Area Network
WORM	Write Once Read Many
XDOD	Xerox Documents on Demand



## REFERENCES

1. Tuey, Richard C., June 1993, NASA Electronic Publishing System - Electronic Printing and Duplicating Evaluation Report, NASA TM-106242.
2. Tuey, Richard C., February 1994, NASA Electronic Publishing System - Stage 1 Evaluation Report, NASA TM-106510.
3. Tuey, Richard C., June 1994, NASA Electronic Publishing System - Cost/Benefit Analysis, NASA TM-106662.
4. General Services Administration Federal Supply Service, FSC Group 36, Part IV, FSC Class 3610, Contract GS-26F-1001B, Period 10/1/93 to 9/30/94 and Modifications 1 to 7 (Rev 2).
5. Xerox Documents on Demand (XDOD) Personal & Workgroup Configuration Solution Product Description, 4th ed., Xerox No: X409-042 (No Date), Xerox Corporation, USCO Solutions and Services Organization, McLean, Virginia.
6. Avedon, Don M., 1994, Introduction to Electronic Imaging, 2d ed., Association for Information and Image Management, Silver Spring, Maryland.



## **APPENDIX 1 - MEMBERS OF EVALUATION TEAM**

- |    |                   |   |
|----|-------------------|---|
| 1. | Dwaine A. Kronser | GSFC Technical Information Services Branch/IPMO       |
| 2. | Bob Lane          | GSFC Printing & Duplicating Services Section          |
| 3. | Fred Moore        | NASA Printing Management Officer                      |
| 3. | Preston Pope      | GSFC Printing & Duplicating Services Section          |
| 4. | Dick Tuey         | NASA Electronic Publishing System Project Coordinator |
| 5. | Theresa Wirth     | GSFC Printing & Duplicating Services Section          |
| 6. | Susan Hart        | GSFC Publications & Graphics Services Section         |
| 7. | Marilyn Tolliver  | GSFC Logistics Management Division                    |
| 8. | Mary Collins      | GSFC Electronic Document Distribution Project         |

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# APPENDIX 2 - COMPARATIVE CENTRAL PRINTING AND COPIER SPECIFICATIONS

03/30/94

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Alternative 3 and 4 Plus Other Options			
Specs	Alt 3 - Network DocuTech (Copier/Central Printer)	Alt 4 - 4135 (Central Printer)	5090 (Copier)
Speed	135 ppm	135 ppm	135 ppm
Resolution	600 dpi	600 dpi	300 dpi
Imaging	laser	laser	Light Lens
Max Paper Size	11" x 17"	11" x 17"	11" x 17"
Stock Bins	3	4 (+1 roll feed opt.)	3
Stock Capacity	4,300	6,900 (+roll feed opt.)	4,300
Duplexing	yes	yes	yes
Stacker	8" x 10" to 9" x 14", 3,000 max	2 @ 2,500 ea.	8" x 10" to 9" x 14", 3,000 max
Stitcher	8x10-9x14", 2-70 sheets (32K /spool)	opt. (finishing partner)	opt. stitcher (2-50 pgs.)
Saddle Stitch	5.5x8.5 & 11x17 in line (opt. sign book maker)	opt. (finishing partner)	opt. (finishing partner)
Thermal Binder	8.5x11" 15-125 sheets, 425 binds /reel	opt. (finishing partner)	opt. (finishing partner)
Duty Cycle	1,000,000 per month	4,000,000 per month	1,000,000 per month
CPU	6 Xenon CPUs	DEC J-11	DEC J-11
RAM	16 mb	n/a	34 microprocessors, 5 mips
Hard Drive	1,140 mb	2 @ 182mb ea. std (1,124 mb opt)	n/a
Interface	Ethernet XNS	Ethernet XNS	n/a
Resident PDL	Interpress	Interpress	Interpress
Emulations	None	None	None
Print Manager	80386 PC	Functionality in Network Server	Functionality in Network Server
Network Server - HW	80386 PC	Sun Sparc 10	Sun Sparc 10
Network Server - SW	PS or HP/PC/L, Novell, TCP/IP, AppleTalk	PS or HP/PC/L, Novell, TCP/IP, AppleTalk	PS or HP/PC/L, Novell, TCP/IP, AppleTalk
Media Server - HW	80386 PC	n/a	n/a
Media Server - SW	DOS, OS/2, Mac, SUN, PostScript or HP/PC/L	n/a	n/a
RAM	8 mb std, 16 mb optional	32 mb standard	32 mb standard
Hard Drive	650 mb	424 mb standard	424 mb standard
PDL's	Postscript level 2 - Adobe, PCL 4 & 5	PS 1&2, HP PCL 4 & 5, TIFF, ASCII, CCITT	PS 1&2, HP PCL 4 & 5, TIFF, ASCII, CCITT
Client Support	IBM PC, Apple Macintosh, Unix Workstation	IBM PC, Apple Macintosh, Unix Workstation	IBM PC, Apple Macintosh, Unix Workstation
Scanner	Scan rate @ 2.5 sec per document, 23 ppm	n/a	n/a
Supply yields	Dry ink = 220k, developer = 750k, fuser agent = 250k	Dry ink = 260k, developer = 600k, fuser agent = 250k	Dry ink = 105k, developer = 300k, fuser agent = 140k
Administration (Accounting)	Stores up to 10,000 accounts	Not applicable, internal to computer complex job control system	Not applicable, internal to computer complex job control system

Note: Alternative 3 - Central Printer @ Computer Center & Alternative 4 - Copier @ Duplicating Facility [Data Source from: Xerox Corporation, Mr. Bob Sullivan, Federal District Operations]

Figure 22. Comparative specifications.

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APPENDIX 3 - NASA GENERAL COUNSEL RULING - JCP's DUPLICATING THRESHOLDS

National Aeronautics and  
Space Administration  
Headquarters  
Washington, DC 20546-0001



Reply to Attn of: GP(94-38058)

May 4, 1994

TO: JTT/Fred W. Moore  
FROM: GP/Nina M. Lawrence  
SUBJECT: Department of Justice (DOJ) Memorandum of April 7, 1994 on Extension of Joint Committee on Printing (JCP) Authority to Duplicating

This is in response to your memorandum of April 21, 1994 in which you inquired whether NASA has to comply with the JCP's duplicating threshold of 5,000/25,000 production units for duplicating facilities. There is no legal requirement that NASA comply with the JCP duplicating threshold. As a matter of policy, NASA may choose to abide by the threshold.

The conclusions reached by the DOJ in its April 7, 1994 memorandum are legally binding on executive branch entities, including NASA. To summarize, DOJ stated that section 207 of Public Law 102-392 gives neither the Government Printing Office nor the JCP any authority over duplicating services, and any attempt by the JCP to assert such authority is invalid. Also, the JCP's "Government Printing and Binding Regulations" are not binding on executive branch entities, but merely provide guidance for the JCP and any entities that choose to abide by them.

If you have any questions, please contact me.

*Nina M. Lawrence*

Deputy Associate General Counsel  
(Intellectual Property)

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## APPENDIX 4 - FTP Log

Log - FTP

10-16-94 6:31:13

SPET: zdot.gfc.nasa.gov

220 PC FTP server (Bname & Whitehead Software(lm) Version 3.1, 1994) ready.

USER dluy

331 Password required for dluy.

PASS \*\*\*\*\*

230 User dluy logged in.

PWS

257 "C:\PUBLIC\DLUY" is current directory.

PORT 131,182,171,242,5,67

200 PORT command successful

TLST

226 Transfer complete.

90 bytes received (1 Kbytes/sec)

DELE EVALRPT1.PB

550 EVALRPT1.PB: No such file or directory.

QUIT zdot.gfc.nasa.gov

SPET: zdot.gfc.nasa.gov

220 PC FTP server (Bname & Whitehead Software(lm) Version 3.1, 1994) ready.

USER dluy

331 Password required for dluy.

PASS \*\*\*\*\*

230 User dluy logged in.

PWS

257 "C:\PUBLIC\DLUY" is current directory.

PORT 131,182,171,242,5,70

200 PORT command successful

TLST

226 Transfer complete.

77 bytes received (1 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,72

200 PORT command successful.

STOR walp1.ps

226 Transfer complete.

2682122 bytes sent (20 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,76

200 PORT command successful.

STOR walp2.ps

552 walp2.ps: No such file or directory.

QUIT zdot.gfc.nasa.gov

SPET: zdot.gfc.nasa.gov

220 PC FTP server (Bname & Whitehead Software(lm) Version 3.1, 1994) ready.

USER dluy

331 Password required for dluy.

PASS \*\*\*\*\*

Page 1

Log - FTP

10-16-94 6:31:13

230 User dluy logged in.

PWS

257 "C:\PUBLIC\DLUY" is current directory.

PORT 131,182,171,242,5,79

200 PORT command successful

TLST

226 Transfer complete.

115 bytes received (0 Kbytes/sec)

QUIT zdot.gfc.nasa.gov

221 Goodbye.

SPET: zdot.gfc.nasa.gov

220 PC FTP server (Bname & Whitehead Software(lm) Version 3.1, 1994) ready.

USER dluy

331 Password required for dluy.

PASS \*\*\*\*\*

230 User dluy logged in.

PWS

257 "C:\PUBLIC\DLUY" is current directory.

PORT 131,182,171,242,5,82

200 PORT command successful

TLST

226 Transfer complete.

115 bytes received (1 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,84

200 PORT command successful.

STOR walp16.ps

226 Transfer complete.

2682122 bytes sent (17 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,88

200 PORT command successful.

STOR walp26.ps

226 Transfer complete.

3605914 bytes sent (18 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,92

200 PORT command successful.

STOR walp36.ps

226 Transfer complete.

3234960 bytes sent (17 Kbytes/sec)

TYPE S

200 Type set to S.

PORT 131,182,171,242,5,96

200 PORT command successful

Page 2

Log - FTP  
10-16-94 6:31:13

276R wslp14.ps  
226 Transfer complete.  
1220522 bytes sent (17 Kbytes/sec)  
276T adact.gfc.nasa.gov  
221 Eosdlp.  
276T doculch.gfc.nasa.gov  
220 doculch FTP server (TulWare v3.12) ready.  
276R wslty  
331 Password required for wslty  
PASS \*\*\*\*\*  
230 User: SW33TJf logged in.  
FWB  
257 "/" is current directory.  
PORT 131,182,171,242,5,101  
200 PORT command okay.  
276T  
226 Transfer complete.  
41 bytes received (1 Kbytes/sec)  
276P  
200 CWS command okay.  
FWB  
257 "/" is current directory.  
PORT 131,182,171,242,5,103  
200 PORT command okay.  
276T  
226 Transfer complete.  
5 bytes received (0 Kbytes/sec)  
276T doculch.gfc.nasa.gov  
221 Eosdlp.  
276T doculch.gfc.nasa.gov  
220 doculch FTP server (TulWare v3.12) ready.  
276R wslty  
331 Password required for wslty  
PASS \*\*\*\*\*  
230 User: SW33TJf logged in.  
FWB  
257 "/" is current directory.  
PORT 131,182,171,242,5,106  
200 PORT command okay.  
276T  
226 Transfer complete.  
407 bytes received (0 Kbytes/sec)  
CWS users  
200 CWS command okay.  
FWB  
257 "/usr/users" is current directory.  
PORT 131,182,171,242,5,108  
200 PORT command okay.

Page 3

Log - FTP  
10-16-94 6:31:13

276T  
226 Transfer complete.  
71 bytes received (1 Kbytes/sec)  
CWS users  
200 CWS command okay.  
FWB  
257 "/usr/users/swusers" is current directory.  
PORT 131,182,171,242,5,110  
200 PORT command okay.  
276T  
226 Transfer complete.  
209 bytes received (0 Kbytes/sec)  
CWS wslty  
200 CWS command okay.  
FWB  
257 "/usr/users/swusers/wslty" is current directory.  
PORT 131,182,171,242,5,112  
200 PORT command okay.  
276T  
226 Transfer complete.  
1021 bytes received (9 Kbytes/sec)  
BELL wslp11.ps  
200 BELL command okay.  
BELL wslp12.ps  
550 Cannot delete wslp12.ps  
BELL wslp13.ps  
200 BELL command okay.  
BELL wslp14.ps  
200 BELL command okay.  
BELL wslp12.ps  
550 Cannot delete wslp12.ps  
TYPE J  
200 Type set to J.  
PORT 131,182,171,242,5,114  
200 PORT command okay.  
276R wslp15.ps  
226 Transfer complete.  
2682122 bytes sent (73 Kbytes/sec)  
TYPE S  
200 Type set to S.  
PORT 131,182,171,242,5,118  
200 PORT command okay.  
276R wslp12c.ps  
226 Transfer complete.  
3605914 bytes sent (73 Kbytes/sec)  
TYPE J  
200 Type set to J.  
PORT 131,182,171,242,5,122

Page 4

Log - JSP

19 16-90 6:31:13

200 PGBZ command okay

8538 waitp3.ps

226 Transfer complete

3234960 bytes sent (73 Kbytes/sec)

JSPC 3

200 Type set to 3

PGBZ 151,182,171,242,5,126

200 PGBZ command okay

8538 waitp3.ps

226 Transfer complete

1220527 bytes sent (66 Kbytes/sec)

2007 doculch.gif nasa.gov

221 Goodbye

\*\*\* End \*\*\*

Page 5

# REPORT DOCUMENTATION PAGE

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Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

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6. AUTHOR(S)  Richard C. Tuey, Robert L. Lane, Susan V. Hart					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS (ES)  Goddard Space Flight Center Greenbelt, Maryland 20771				8. PERFORMING ORGANIZATION REPORT NUMBER  95B00026	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS (ES)  National Aeronautics and Space Administration Washington, DC 20546-0001				10. SPONSORING / MONITORING AGENCY REPORT NUMBER  NASA TM-104615	
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13. ABSTRACT (Maximum 200 words)  The NASA Scientific and Technical Information Office was assigned the responsibility to continue with the expansion of the NASAwide networked electronic duplicating effort by including the Goddard Space Flight Center (GSFC) as an additional node to the existing configuration of networked electronic duplicating systems within NASA. The subject of this report is the evaluation of a networked electronic duplicating system which meets the duplicating requirements and expands electronic publishing capabilities without increasing current operating costs. This report continues the evaluation reported in "NASA Electronic Publishing System -- Electronic Printing and Duplicating Evaluation Report" (NASA TM-106242) and "NASA Electronic Publishing System -- Stage 1 Evaluation Report" (NASA TM-106510). This report differs from the previous reports through the inclusion of an external networked desktop editing, archival, and publishing functionality which did not exist with the previous networked electronic duplicating system. Additionally, a two-phase approach to the evaluation was undertaken; the first was a paper study justifying a 90-day, on-site evaluation, and the second phase was to validate, during the 90-day evaluation, the cost benefits and productivity increases that could be achieved in an operational mode. A benchmark of the functionality of the networked electronic publishing system and external networked desktop editing, archival, and publishing system was performed under a simulated daily production environment. This report can be used to guide others in determining the most cost effective duplicating/publishing alternative through the use of cost/benefit analysis and return on investment techniques. A treatise on the use of these techniques can be found by referring to "NASA Electronic Publishing System - Cost/Benefit Methodology" (NASA TM-106662).					
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